ANGLIA RUSKIN UNIVERSITY

FACULTY OF HEALTH, SOCIAL CARE AND EDUATION

STUDENTS’ FAMILIARITY WITH THE NARRATOR IN MULTIMEDIA LEARNING MATERIAL

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ABSTRACT

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Abstract

This is a study of the influence of the familiarity of students with the narrator of video tutorials, in a blended learning situation, on both the perceived and actual effectiveness of the learning materials, in terms of students' learning efficiency – where a course is traditional in format and online learning is carried out with the help of Narrated Video Screen Captures (NVSCs). The study also focused on the interaction of student-narrator gender similarity and students' individual differences (conscientiousness and test-anxiety) with voice familiarity. Thus, the study sought to fill a gap in knowledge regarding the influence of familiarity with the narrator in multimedia learning material on the efficiency of learning within a blended learning context.

The research paradigm was deductive, employing a mixed methods and a case study research and using quasi-experiments. In order to compare the relational efficiency of the different instructional conditions, a calculative approach was used that combined measurement of mental effort with task performance. In addition to the mental effort questionnaires and task performance, students completed an assessment questionnaire for the NVSCs. In addition, semi-structured interviews and a follow-up questionnaire were used for collection of corroborative data, in order to shed more light on this matter.

Findings showed significant influence of voice familiarity on most of the learning efficiency indices and on perceived effectiveness of NVSCs. Gender similarity was significant only with unfamiliar voice and there was no significant interaction between conscientiousness and test anxiety and voice familiarity.

Thus, it was concluded that when students have a personal relationship with the class teacher, exposure to multimedia learning materials with an unfamiliar narrator has an adverse influence on their learning efficiency. These findings add to the established voice related principles of ***Cognitive Theory of Multimedia Learning*** and ***Social Agency Theory.*** Contribution to knowledge was made by filling the gap in knowledge in the area of multimedia instructional design.

Key words: cognitive load, social cues, multimedia learning, voice familiarity, learning efficiency, instructional design.

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Acronyms/Abbreviations

3D-E-Rec	Three Dimensional Learning Efficiency in Recall task
3D-E-Trn	Three Dimensional Learning Efficiency in Transfer task
APA	Animated Pedagogic Agent
CATLM	Cognitive-Affective Theory of Learning with Media
CLT	Cognitive Load Theory
CTML	Cognitive Theory of Multimedia Learning
GLO	Generative Learning Object
GPA	Grade Point Average
HE	Higher Education
HCI	Human Computer Interaction
ICT	Information and Communication Technology
LCMS	Learning Content Management System
LMS	Learning Management System
LO	Learning Object
LPE-Rec	Learning Process Efficiency in Recall task
LPE-Trn	Learning Process Efficiency in Transfer task
LTM	Long Term Memory
MANCOVA	Multivariate analysis of covariance
MM	Multimedia
MSLQ	Motivated Strategies for Learning Questionnaire
MT-Rec	Motivation on Recall task
MT-Trn	Motivation on Transfer task
NVSC	Narrated Video Screen Capture
NEO-FFI	Neuroticism-Extroversion-Openness Five Factor Inventory
NVSC-A	Narrated Video Screen Capture Assessment
PBC	Planning and Budgeting Committee
OER	Open Educational Resources
OEM	Open Education Movement
RLO	Reusable Learning Object
TE-Rec	Task Efficiency performance in Recall task
TE-Trn	Task Efficiency performance in Transfer task
WM	Working Memory

Glossary of the key concepts in the study

Blended learning

Blended learning can assume various forms of blending face-to-face with online teaching. There are courses in which all the subjects are taught traditionally while an accompanying website offers the students auxiliary materials for the purpose of revision and consolidation of the material delivered in the classroom. Courses exist in which a limited number of traditional face-to-face sessions are held, with most of the learning done online and there are courses in which instruction is generally traditional and only a certain number of subjects are studied online by the students independently.

Cognitive Load Theory (CLT)

This proposes that since working memory is limited, learners may be bombarded by information and, if the complexity of their instructional materials is not properly managed, this will result in a cognitive overload. This cognitive overload impairs schema acquisition, resulting in a lower performance.

Cognitive Theory of Multimedia learning (CTML)

Based on the principles of cognitive load theory, the cognitive theory of multimedia learning emphasises the integration of audiovisual information in working memory and its impact on cognitive load and hence on learning.

Cognitive-Affective Theory of Learning with Media (CATLM)

An integrative model, where cognitive processing is the result of the interaction between the learner's knowledge, abilities, beliefs, affect and motivation.

Computer Literacy Course

A course offering the skills that are considered basic for computer usage in the academic environment: i.e. use of word processors, presentations creation, net surfing, sending and receiving emails, preparation of electronic spreadsheets and understanding of the operating system.

Conscientiousness

A trait defined by sub-traits such as: responsibility, reliability, diligence, readiness to adapt to new rules, efficiency, organisation, planning and achievement aspirations. Highly conscientious people always aspire to achieving the best results by proper organisation of their time and study. Thus, **conscientiousness** is highly correlated with motivation and has a positive effect on academic performance.

Effectiveness

In the context of the present study, effectiveness is related to the task performance scores in the various learning conditions where higher scores demonstrate higher learning effectiveness.

Efficiency

In the context of the present study, efficiency in learning is related to the mathematical difference between the standardised Z scores of performance gain and mental effort experienced by the student during learning or during task performance. Low mental effort associated with high task performance demonstrates higher learning efficiency.

Element interactivity

The amount of interacting elements the learner has to deal with during learning.

Extraneous load

The cognitive load, caused by extraneous processes, which are the result of deficient design of the instructional method and materials caused by learning material with unnecessary high element interactivity.

Familiarity with the narrator

Familiarity is related to the acquaintance and personal relationship students have with their class teacher through face to face lessons.

Germane load

Germane cognitive load is related to the amount of WM resources the learner allocates to germane processes in order to handle essential element interactivity.

Information and Communications Technology (ICT)

In education, this deals with the use of computers and communication for learning.

Instructional design

The practice of maximising the effectiveness, efficiency and appeal of instruction and other learning experiences.

Intrinsic load

Cognitive load caused by the learning material's essential element interactivity. This load cannot be changed without changing the essence of the learning task.

Learning (Content) Management System (LCMS or LMS)

This is a software application for the administration, documentation, tracking and reporting of training programs, classroom and online events, e-learning programs and training content.

Learning objects

These are elements of computer-based instruction, grounded in the object-oriented paradigm of computer science that can be reused in multiple contexts by different users.

Media Equation Theory

A theory, which suggests that people relate to computers, television and new media as real people.

Narrated Video Screen Captures (NVSC)

Video tutorials that are produced using video screen capture type software. NVSCs exhibit the activities taking place on the computer screen and concurrent recording of the teacher's narration explaining the various operations.

The Adult learner

The adult learner is defined as one who has some or all of the following characteristics: over age 24, married, with children, holds a full or part-time job, or various monetary commitments and social responsibilities.

Procedural learning

Learning method, which emphasises learning of skills and steps that must be executed in a given sequence in order to proceed from the start to the end state.

Similarity Attraction Principle

This principle suggests that individuals tend to be attracted and have more positive interaction with those similar to themselves.

Social Agency Theory

According to this theory, social cues, coming from multimedia learning material, can make learners feel in a social interaction with the computer and thus, make them automatically activate the social schema stored in long term memory, which consequently relieves the burden on the working memory and enable more effective learning by allowing more working memory resources to be allocated to germane processes.

Test-anxiety

A personality makeup that has a negative effect on the academic performance of a student. It is composed of a number of dimensions, including cognitive, affective, psychological and behavioural responses to situations that contain a dimension of evaluation.

Traditional (face-to-face) Learning

This takes place in the classroom where the teacher and students are physically present.

Prologue - How did I arrive at this subject? - The exploratory research

I have been teaching ***Computer Literacy*** for several years and am constantly encountering situations in which students complain that they find it difficult to remember all the material that has been covered in class. Even though the learning does not involve rote memorisation, since they work through visual contact with programs, they nevertheless, find it difficult to remember all the procedures involved in executing certain functions, especially if these entail a number of steps that must be carried out in succession. Learning computer skills is procedural (Anderson and Krathwohl, 2001), which means learning steps that must be executed in a given sequence, perhaps not related so much to an understanding of abstract concepts, but rather to the internalisation of steps that must be performed consecutively. On seeing that there was a problem, I thought of using the website accompanying the course to upload auxiliary materials for the students. I was aware, that there was a difference between individual students and that each one had his/her own preferred method of learning. I, therefore, decided to upload materials in different media, trying to address students' different preferences. In addition, I conducted an exploratory research, which lasted for two academic years- 2006 and 2007, with a view to seeing which materials would be most suitable. I was interested in knowing which of the materials the students would prefer, and especially wished to find out if this was connected with a certain learning style or learning preference, to which I could adapt the learning materials. During the exploratory research, students' learning styles were evaluated using the Felder-Silverman Index of Learning Styles (ILS) tool, very often used in HE (Felder and Spurlin, 2005). However, learning styles were not used in the present research because of the students' overall preference for the same type of learning material, i.e. Narrated Video Screen Captures (NVSCs) and the subsequent revision of the research question.

The materials uploaded to the website comprised detailed texts similar to those found in the textbooks with screen prints by way of explanations. Another kind of textual material included documents with abbreviations of all the commands learned in class. There were also static screen prints presentations and NVSCs featuring video screen captures of the various commands with my narration. All the subjects were covered in the above mentioned various media, making it possible to learn them through any media of one's choice.

Administering a feedback tool, in the academic year 2007, it was apparent that the students preferred the video demonstrations. This was consistent (the statistics of the feedback from students can be reviewed in Appendix XA). In addition, using web-mining procedures, I realised that shortly before the examination numerous hits had been made on the study materials. In the case of textual and graphic materials, the hits were sparse and were apparently intended only for a preliminary investigation of the material, as there were only few cases of second hits. For the NVSCs, in contrast, there were repeated hits, even for the same recording. Clearly, there were students who did not access the website at all, but those who did, sought mainly the NVSCs. The computer reports showed that the usage of NVSCs rose from the academic year 2006 to the academic year 2007, and became the main source of auxiliary learning material for the students (Appendix XB).

Interviewing the students after their examinations (Appendix XC- sample interview), I learned that there was a consensus that the NVSCs were helpful, but that the rest of the material was unnecessary and did not reach the standard of the video materials. It was clear from the interviews that the students actually enjoyed listening to a familiar voice and that it made them relive the lesson. Students gravitating towards the NVSCs, was in line with research that indicated that students do show a preference for learning material that includes dual modality, i.e. graphics and audio (Veronikas and Maushak, 2005; Mayer, 2005a; Tynan and Colbran, 2007; Mandernach, 2009; Luna and Cullen, 2011). The exploratory research findings were also in line with the findings of the Informal Mobile Podcasting and Learning Adaptation project (IMPALA, n.d.), with regard to students' preference of MM material rather than text or screenshot manuals (Mount and Chambers, 2008). However, it also occurred to me that the attraction stemmed not only because video materials might be more appealing, but also from the fact that the recordings represented something personal, my voice maybe infusing them with a sense of familiarity or security that the material was trustworthy. In the light of the criticism leveled at learning styles (Coffield, et al., 2004a; 2004b), along with findings that students' learning styles did not affect performance with multimedia (MM) learning (Clark and Feldon, 2005; Moreno and Plass, 2006) and a study (Santo, 2006) that found that the learners' computer skills and level of motivation may be more influential on their performance than addressing their learning styles, I decided to abandon the learning styles variable all together. Nevertheless, it should be noted that some other studies found that audio podcasts may benefit auditory learners (Sun, et al., 2003; Cebeci and Tekdal, 2006; Clark and Walsh, 2006 cited in

Rosell-Aguilar, 2007, p. 10). Yet, I wanted to see whether it was the familiar voice that mattered. Moreover, from the point of view of the efficiency of learning and results, I wanted to check whether significance could be ascribed to the familiarity with the voice of the narrator.

In order not to cause the students, who participated in the exploratory research, any discomfiture by asking them if it was important for them that the voice be mine; they could fear insulting me by saying that it did not matter whose voice they heard, i.e. the *Hawthorne effect* (McCarney, et al., 2007), I posed the question differently, presenting them with a concrete problem. I told them that, as they had seen on the course website, the recordings had been made for Office 2007 applications, the year before there were NVSCs for Office 2003 applications and that once we switched to the newer version I would have to redo all the recordings to suit Office 2010. I presented this to the students as a problematic task and said that ahead of the switch to the newer version I was considering a co-operative effort of a number of lecturers, with each lecturer assuming responsibility for specific topics. We would thus divide the work between us and ultimately obtain recordings for the new version to which a number of lecturers would contribute. In presenting the question like that, I made them think how best to ease the work for me, while still considering their own good. Many of them insisted all the same that in their opinion I should perform the recordings myself, saying in so many words, 'We understand your problem but I personally would prefer the voice to be yours'. I nevertheless persisted, saying, 'But what if the material, the subjects and the texts are the same'? The reply was, 'Yes, but when it is your voice we actually see you in the classroom, we are reassured, it is familiar and it is more fun to learn this way'. Some expressed it even more decisively: 'We understand the problem you have in recording everything again but if it is the good of the students you want, it would be better if it were your voice'. These responses were fairly consistent in one way or another for many of the students who were interviewed. There were even some who said that it would make no difference if I told them that the recordings of the other teachers had my approval. Clearly, there were also students who said that they did not see any problem with listening to unfamiliar voice. However, the insistence of the others as to the importance of the narration being mine raised my curiosity, especially in light of studies that found that learning materials that are of top preference by the students do not necessarily prove to be the best when measuring their learning outcomes (Clark and Feldon, 2005).

Chapter 1 - Introduction

The following is a general review of the study environment and the background that led to the research question and consequently to the research hypotheses.

1.1 Preface

The question that emerged from the data gathered for the exploratory research interviews concerned the possible influence of the teacher's familiar voice on students' learning with MM learning material. Advertising research shows that brand recall is higher when the voice is a celebrity, and therefore familiar to the listener (Levi and Pisoni, 2005). Thus, It is common practice to recruit celebrities for advertisements (Nass and Brave, 2005). However, the significance of such familiarity from the point of view of learning is not clear– does the teacher, who is known to all from the classroom, have the same influence, in measured terms, as the celebrity in an advertisement? Effectiveness in advertising is gauged by the degree to which the target audience is persuaded to buy a certain product. What happens in learning? Is there a question of persuasion here? There must be a difference. Teachers do not have to persuade the students to perform a particular procedure, they want to help the students acquire a skill, which they need to perform correctly. Thus, the research question that was raised was: Is there an influence on students' learning, of familiarity with the narrator of MM learning material in a blended learning environment?

1.2 Trends in Higher Education-widening participation

Registration for institutions of HE has risen rapidly during the recent past and the trend appears to be continuing. In the USA, for example, the number of registrants for HE rose by 170%, during the years 1970 - 2000 (Aslanian, 2001). This rise is expected to continue and even intensify as the world becomes more complex and potential sources of employment increasingly require academic knowledge (AAC&U, 2002).

The above reported growth is due to the global policy trend, since the 1990s, to widen access to HE for backward populations, with the aim of improving social equality, as exemplified by the UK (Yorke and Longden, 2008; Gov.uk, 2012) Ghana (Effah, 2011), Ireland (Keane, 2011), the USA (Jackson, 2012) and Israel (Ayalon, 2008), to name a few.

In order to put this policy into practice, many institutions have obtained academic recognition and have begun to ease their conditions of admission (Ayalon, 2008; Ellison and Gammon, 2011). The policy has prompted these academic institutions to open their doors to populations that would not have been accepted in the past, including working class individuals, women, older students and members of ethnic minorities (Leathwood and O'Connell, 2003). The opening of the HE system to new social groups has increased class, ethnic, gender and age variations in the population of students in HE institutions and has contributed to the democratisation of the system (Brubacher and Rudy, 1999). However, despite the widening access policies and increasing student numbers, research suggests that social inequality continues to be a problem in HE (Moreau and Leathwood, 2006). Despite efforts, the new students do feel different and experience a sense of not belonging (Bourdieu and Wacquant, 1992; Yorke, 1999; Leathwood and O'Connell, 2003) and low social class potential students are deterred by the tuition fee they cannot afford (Callender, 2003; Callender and Jackson, 2005). New gaps have also been created, this time between the graduates of established prestigious universities and those of the new academic institutions, whose image is inferior and whose degrees are less valued (Thomas, 2001; Volansky, 2005). Some academics have expressed opposition to the policy of expanding access to HE and claim that this policy is causing HE standards to drop (Furedi, 2004; Leathwood and Read, 2009). Nevertheless, forecasts show that the policy will continue, regardless (Kelly and Strawn, 2011).

The new students who have joined the HE system are defined as ‘non-traditional’ (Medway, et al., 2003, p.3). The National Center for Education Statistics (NCES) has defined seven characteristics found to be common to non-traditional students and a student who fits any one of them is considered non-traditional:

- Delays enrollment (does not enter postsecondary education in the same calendar year that he or she finished high school);
- Attends part time for at least part of the academic year;
- Works full time while enrolled;
- Is considered financially independent for purposes of determining eligibility for financial aid;
- Has dependents other than a spouse ;

- Is a single parent ; or
- Does not have a high school diploma; (Choy, 2002, p.2)

1.3 Widening participation in Higher Education in Israel

Israel has joined the global trend by widening access to its HE system (Arum, Gamoran and Shavit, 2007). In 1991 Israel signed the International Covenant on Economic, Social and Cultural Rights (ICESCR), Clause 13 of which states in connection with the right to higher learning: 'Higher education shall be made equally accessible to all, on the basis of capacity, by every appropriate means and, in particular, by the progressive introduction of free education' (UNESCO, 1999, p. 9). Although this has not been adopted as a basic right according to legislation in the State of Israel, it does oblige the government – on the official level – to advance access to and equality in the HE system (CHE, 2011), see also Appendix A.

In contrast to other countries, where students can start their bachelor degree studies immediately after high school, at the age of 18, in Israel men are called up after high school for compulsory military service for three years and women are called for two years. In other words, under normal circumstances, students in Israel do not begin their studies before the age of 20-22 (with the exception of those who have obtained an exemption from military service for a variety of reasons). The median age for entry into the HE framework in Israel is 23.7 *versus* 20.4 in OECD countries and one of the principal reasons for the difference is military service in Israel and the increasing trend among youth to do a year of community service prior to joining the army (OECD, 2010).

1.4 The Academic College where the research was conducted

The academic college where the research took place is a private face-to-face oriented institution. The student population is comprised mainly of Israeli Hebrew speaking students, along with Arab students and new immigrants mainly from Russia, Ethiopia and France.

Following is Table 1-1, which describes the college student population in the academic years 2008, 2009 and 2010, in terms of gender and age; (Due to college ethics regulations students are not required to report their place of birth and ethnicity. None of the first year students have a prior academic degree):

Table 1-1: The profile of student population in the Academic College

2008						
gender		age				
male	female	17-21	22-28	29-35	36-45	46+
45%	55%	21%	61%	11%	5%	2%
2009						
gender		age				
male	female	17-21	22-28	29-35	36-45	46+
45%	55%	17%	55%	16%	8%	4%
2010						
gender		age				
male	female	17-21	22-28	29-35	36-45	46+
45%	55%	18.4%	61.1%	12.2%	6%	2.3%

Although the research was conducted during one academic year, which started in November 2010, the college population characteristics were checked for three consecutive years (2008-2010), in order to demonstrate that this college's population is non-traditional. Table 1-1 shows that the academic years 2008-2010 indicate a constant pattern of students' gender, i.e. more female students (55%) than male (45%) as also found in Dagan-Buzaglo (2007) and Leathwood and Read (2009). It is also shown that most of the students (app. 80%) were adults aged 22-46+. As shown in Table 4-3 and further described in section 4.8, the participants of the present research match the non-traditional students' characteristics (section 1.2), in relation to their age, which ranged from 19 to 45 and their social obligations, e.g. work, married life and children. It should be noted, that despite the consistent pattern in the college of more females than males, the present research population, which was a convenience sampling (see section 4.7), consisted of 43.5% females and 56.5% males.

All the teachers in the college have recourse to the facilities of a web-based Learning (Content) Management System (LMS or LCMS). The college is private, not budgeted by the PBC, supervised by the Israeli Council for HE and has received accreditation and authorisation to award Bachelor's and Master's degrees; Bachelor's degrees in Business Administration, Computer Sciences, Banking, Behavioural Sciences and Insurance and Master's degrees in Business Administration, Communications, Law and Organisational Behaviour.

Computer Literacy is a one-semester mandatory course, as part of a Bachelor's degree, in all departments in the college in which the current study was conducted. ***Computer Literacy*** courses take place in the computer laboratory, with the number of students ranging from 30 to 50.

As a ***Computer Literacy*** teacher in that college, I was interested in investigating how familiarity with the narrator on MM materials embedded in the course website influences students' learning in a blended learning environment.

1.5 Blended learning

In recent years, the use of blended learning in the field of Higher Education (HE) has witnessed considerable expansion (Osguthorpe, 2003; Bersin, 2004; Garrison and Kanuka, 2004; Heinze and Procter, 2004; Bonk and Graham, 2006; Falconer and Littlejohn, 2007; Krause, 2008) and there is a growing body of research which supports the idea that the preferred mode of learning in today's HE is a one which combines both traditional teaching and technology mediated instruction via a course website (Bonk, 2009; Means, et al., 2009; Žuvic-Butorac, et al., 2011).

Blended learning can assume various forms:

- Courses exist in which a limited number of traditional face-to-face sessions are held and most of the learning is done online;
- There are courses in which instruction is generally traditional and only a certain number of subjects are studied online by the students independently;
- Courses may be found in which all the subjects are taught traditionally while an accompanying website offers the students auxiliary materials for the purpose of revision and consolidation of the material delivered in the classroom.

The latter was the environment in which the study took place.

1.6 The use of multimedia learning material in the course website

The general aim of the study was to develop research-based knowledge of how best to use MM learning material in a way that addresses the students' learning needs from the perspective of cognitive load. In particular, the research aimed to find out whether familiarity with the narrator in video tutorials, produced in the format of NVSCs, has any impact on students' efficiency of learning.

The types of learning materials that instructors usually upload to a course's learning environment can be extremely varied:

- Texts;
- Presentations;
- MM material like animated tutorials, video podcasts (also called vodcasts) and narrated video screen captures (NVSCs);
- Podcasts (audio productions);

A trend that is currently gaining ground is the use of MM learning materials, commonly used in virtual learning environments for online study and blended learning (Brown, Luterbach and Sugar, 2009; Purcell, 2010). Recently, a technology has been developed that also allows educators who are not technological experts to develop high-level MM learning materials themselves, e.g. systems which allow automatic lecture captures during a live class session for future use by the students (Rui, et al., 2004; Zhu, 2008). Studies report of students' preference and satisfaction of this kind of reference and self-study material in blended learning environments (Edirisingha, Rizzi and Rothwell, 2007; Watson and Boggs, 2008), including podcasts which have only audio features (Salmon and Edirisingha, 2008; Heilesen, 2010). The technology of lecture capture using software like Microsoft Producer^{TM} , Tegrity^{TM} or TechSmith Camtasia Studio^{TM} allow instructors to record lessons, featuring themselves or, alternatively, only the computer screen they are using if, for example, they are delivering their subject in the form of a Microsoft PowerPoint presentation, or they are focusing on software or other computer subjects. These MM productions may need some editing but an advanced technology is also offered that allows an automated capturing and synchronising that minimises the pre and post-production time, i.e. iCam2^{TM} (Zhang, et al., 2008). Relatively simple software like Microsoft Windows Media Player^{TM} or Apple Quick Time^{TM} enables students to view the recorded lectures after a lesson or instead of the lesson. Much importance is attached to the uploading of high quality learning materials that will support the learning process and meet the learning needs of the students. Thus, the process of preparing learning materials necessitates a great amount of thought and time.

The present research examined the influence of listening to narration on MM study matter in an unfamiliar voice, when the material is related to subjects that have been taught frontally in the framework of the course with a teacher who is known to the students and with whom a personal connection has been established.

The research hypotheses, were based on Cognitive Load Theory (Sweller, Ayres and Kalyuga, 2011), MM instructional design theories, i.e. Cognitive Theory of Multimedia Learning (Mayer, 2005a), Cognitive Affective Theory of Learning with Media (Moreno, 2005) and Social agency theory (Mayer, 2005b), see Chapter 3. It was assumed that learning is more efficient when students, who take a certain course of study, have recourse to an accompanying website containing auxiliary materials and narration featuring the voice of a teacher with whom they are familiar. The assumption being, that a familiar voice elicits more social cues with more positive interaction with the computer and thus, causes less cognitive load than an unfamiliar narrator.

1.7 The practical rationale for this research

Many lecturers integrate MM learning materials with websites accompanying their courses and some scholars have predicted that it will become a standard of course delivery (Norberg, Dziuban and Moskal, 2011). Moreover, this kind of blended learning is also popular among students (Cullen and Foster, 2007, Jeffrey, et al., 2012). In fact, blended learning was found to benefit universities, government and workplaces (Bonk and Graham, 2006). In addition, many initiatives exist for the setting up of repositories containing thousands of learning units, also called ‘learning-objects’ (see section 2.1.4), for multiple use (reusable learning objects), which are developed by educators throughout the world and from which other educators can download learning units for their own students. Since studies show that the affective dimension may affect learning (Moreno, 2010), educators will benefit from knowing if there is also an affective significance to the MM learning materials provided to students whom they teach. The emphasis is on narrated MM materials. If no influence can be attributed to the degree of familiarity with the narrator and if students who study with a regular teacher can be assisted by any source of learning materials to an equal degree of effectiveness and efficiency, then teachers will be able to collaborate and share MM materials between themselves, downloaded from repositories and other sources. This is of particular importance in the teaching of subjects in which the course materials vary with great frequency, such as, for example, computer applications, where there is a need to develop all the learning materials anew once every two to three years.

Educational studies aim to gain more understanding and insight into the optimal conditions under which learning can be successful, allowing instructional support and enabling students to apply their acquired knowledge and skills in new or familiar situations (Swann, 2003). Thus, in relation to the present study, it is important to ask the questions:

- Can use of MM learning materials with narration by an unfamiliar teacher lower the efficiency of learning? and if so
- Is it important and justified (economically and time-wise) to make a greater effort and provide the students with learning materials that feature narration with a teacher who is known to them from the regular frontal course?

Knowledge of the impact of an unfamiliar narrator on students is of great value for HE in Israel, where this research took place, because college students in Israel are adults, many of them hold full or part time jobs and some of them have children (see Table 4-3), which causes them to miss classes occasionally. Moreover, in Israel many students, particularly men, go to reserve duty for various periods ranging from one week to 45 days (IDF, n.d), during the academic year, missing regular classes. Reference material on the course website is their source for catch-up classes. That is, they need to learn some of the time some of the material themselves, while the primary relationship is with the course instructor.

1.8 A statement of the original contribution to knowledge

This research aimed to develop an understanding of how MM materials used within a blended learning situation affect students' learning efficiency, when the narration in those learning material is not by the familiar course instructor. Thus, a contribution was made by filling the gap in knowledge in the field of MM instructional design, regarding the influence that the students' familiarity with the narrator has on their learning, from the perspective of cognitive load.

The conclusions might also have implications for instructors, exposing them to research-based knowledge, according to which they will know under which circumstances it is possible to share MM learning materials with other educators and refer their students to repositories containing MM material.

1.9 The structure of the thesis

Chapter 1 of this thesis presents a description and a discussion of the academic environment in which the present study took place, i.e. Computer Literacy course in HE conducted in a blended learning format with non-traditional students. Chapter 1 introduces also the rationale and statement of contribution to knowledge of the present research.

Chapter 2 presents current literature pertaining to the context of the research, i.e. Open Educational Resources (OER), instructional design, Human Computer Interaction (HCI), and digital literacy. In this chapter, a rationale is given as to why a pedagogical approach was taken in the Computer Literacy course, despite the fact that the research population was an adult one and adult learning theories might have been expected to be used.

Chapter 3 presents current literature pertaining to the cognitive load related theories underpinning the research hypotheses, in designing MM learning and the role human voice plays as a social agent and thus, affecting learning. A gap in knowledge is established from the perspective of MM instructional design, based on cognitive load related theories. Hypotheses are framed in relation to the influence of familiarity with the narrator in MM learning, on students' learning efficiency and motivation on task, in regards to *similarity attraction principle* (student-narrator gender similarity) and individual differences that might interact with voice familiarity, i.e. conscientiousness and test-anxiety, as well.

Chapter 4 describes the methodological choices and the considerations for designing a mixed methods research. Chapter 4 begins with a discussion of the research paradigm and continues with establishing the educational research model and defining the variables and the controlling variables, the quasi-experimental research design, the convenient sampling and role of the researcher and finally data collection tools and ethical aspects.

Chapter 5 presents the findings that emerged from the various research tools in relation to the hypotheses and the corroborative data.

In Chapter 6, the findings are discussed, while making links to the literature survey that illuminated the research, in order to advance strong evidence-based conclusions to emerge. At the end of the chapter, there is a conclusion with possible implications for MM instructional design. Finally, an account is given of the limitations of the study and the contribution of this research to theoretical and practical knowledge in the domain of MM instructional design.

Chapter 2 - Theoretical perspectives: the context of the research

The conceptual framework that underpins the context of the present research, relied on various theories and terms related to Open Educational Resources (OER), instructional design, Human Computer Interaction (HCI), adult learning theories and digital literacy, which will be discussed in the present chapter. Additional theories and conceptual framework that underpin the research hypotheses, i.e. theories related to cognitive load, instructional design of MM learning and theories related to individual differences, will be discussed in Chapter 3.

2.1 Open Educational Resources (OER)

The context in which the current research has been conducted belongs to the Open Education Movement (OEM) in general and to Open Educational Resources (OER) in particular. The aim of this section is to explain the nature of OER, the expected potential for educational purposes, as well as the problems, questions and debates that still arise in connection with them. An explanation on the nature of OER as a general category will be followed by a review of Learning Objects (LOs), the latter being the units of which OER are composed and which are designed for specific teaching goals. A description will be presented of the debates they give rise to and their connection with the research, since the NVSCs that served for the present research are in fact, LOs.

2.1.1 What are OER?

Openness, as a topic, stands at present at the forefront of education (Wiley and Green, 2012) and is part of the Open Movement, which is a general concept that includes the notion of a society that is open with respect, inter alia, to the arts, education, software, research and copyrights. The OEM has adopted digital technology as the primary means for applying its principles and is gaining momentum, being facilitated by the Internet.

OER offer an innovative approach to development, dissemination and assimilation of knowledge. The study content is varied, ranging from entire courses to small units, i.e. LQs, and could include text, images, simulations, video games and other features. The promoters of the content are private individuals – teachers/students, commercial firms and educational organisations. OER can fill different roles in education – they can support and enrich the curriculum or serve as a curriculum in themselves. In any event, their primary goal is to provide the student with a better learning experience (Glennie, et al., 2012). The philosophical principle underlying the opening up of learning content to all is that knowledge is a public good and any individual belonging to human society has the right to access and use this knowledge (UNESCO, 2005). Moreover, according to Bonk (2009), free access to this content is a key component in assisting a person to learn, while Wiley (2010a) emphasises that education is, by its very nature, a collaborative concept and we must therefore ensure that it is available to all.

The OER movement began with MIT's open courseware project in 2001 (MIT, 2001), winning the enthusiastic approval of numerous educational institutions throughout the world (Caswell, et al., 2008; Wiley and Hilton III, 2009). UNESCO also pointed to the potential inherent in these learning materials for developing countries and in 2002 coined the term 'Open Educational Resources' while initiating enhancement of global awareness under the slogan 'Education for All' (UNESCO, 2012a). With monetary assistance from the William and Flora Hewlett Foundation (Hewlett, n.d), the Open Courseware Consortium was established in 2005, which as of 2012 included more than 300 educational institutions in 50 countries (Ocwconsortium, n.d). Other entities also suggested definitions for OER, such as OECD (2007) and OERcommons (OERcommons, n.d.). An additional sponsor of OER development and dissemination is the Commonwealth of Learning (COL, n.d.). The European Commission issued a notice for the selection of public consultants on the subject of opening up education (European Commission, 2012) and in the same year, UNESCO proposed policy and guidelines for application and standardisation of OER in HE (UNESCO, 2012b).

What is common to most of the definitions is the consensus that OER contain content, software tools and licenses, the emphasis being that these are free sources that are open to all, distributed using ICT for the purpose of utilisation and adaptation for non-commercial purposes. However, an additional level was added to these definitions by Kanwar, Balasubramanian and Umar (2010). According to them, OER alone are not enough to make a significant change in education and in order for such a change to occur, they must incorporate the practice and culture of educational systems. In other words, the emphasis is transferred from OER to OEP (Open Educational Practices) and OEC (Open Educational Cultures) and according to Creelman and Ossiannilsson (2012), OEP and OEC are already transferring the handling of OER to the level of policy, involving decision making based on local and international policy, for encouraging and developing the use of OER. Accordingly, OER are benefiting from management on a government level and many countries worldwide are taking policy measures to foster their use, among them Brazil, China, India, the Netherlands, the UK, USA and more (Hylén, et al., 2012).

2.1.2 Potential advantages of OER for the educational system

There are great expectations that OER will change the face of education throughout the world, as expressed by Wiley, Green and Soares (2012) in the Commonwealth of Learning website: 'We are in the midst of a revolution in education. For the first time in human history we have the tools to enable everyone to attain all the education they desire and best of all, this education is available at almost no cost'. These authors claim that since the learning materials are free and since many educational institutions include online learning in their curriculum, OER producers should be spurred to improve their learning materials and to publish only high quality content. They point to the benefits of OER which could provide institutions using them with an opportunity to raise the level of their materials and improve their courses. Thus, the use and creation of OER hold potential advantages for learners, teachers and institutions.

The individual learner is allowed access to a wide range of learning materials and as regards teachers, the creation and sharing of OER can boost professional recognition and bring about an improvement in the efficiency and quality of new learning materials, courses and curricula and since the sharing of learning materials increases transparency, it could provide an impetus for the production of better learning materials. OER can also enhance efficiency by preventing duplication, since there is no need for different learning institutions or teachers to develop the same learning materials. Moreover, the more an institution releases learning material for free use, the more it profits financially, since learning materials of a high standard enhance its reputation and attract more students to register for its courses (Dodds and Fletcher, 2004; Wang and Hsu, 2006; Macintosh, Mcgreal and Taylor, 2011).

2.1.3 Controversy over OER

According to Wiley (2010a), each of the words making up the term 'Open Educational Resources' is lacking in clarity. To begin with, the word 'open' can span a very wide range and can be interpreted as much more than simply access to free learning materials on the Internet. Embedded in it are philosophical and political concepts and it is a source of tensions and criticisms among stakeholders and experts in the field.

In his blog, Wiley (ibid) raises questions like: Must the definition of OER also include a requirement for an open content license?; Does unpaid access to learning materials make them OER?; Must the definition of OER also include permission for modifications and adaptations?; Is earning a livelihood from OER permissible?; Is restricting reuse of OER allowed? and should the definition of learning materials such as OER be made contingent on their dissemination in the form of editable files?

As stated, the problem is that it is not always clear what the term 'open' means. Two important aspects associated with openness are free availability of learning materials on the Internet and a minimum of restrictions. Restrictions can vary, including, for example, technical restrictions, password control, need to pay and copyright protections. The aim in openness is that the users should be able not only to use these materials, but also to modify them and adapt them to their needs. According to Walker (2005), it is the possibility of use anywhere by anyone, Downes (2007a) claims that the term 'open' means that the material is available to the learner free of charge and Daniel (2006, p.20) states his 4 A's:

- Accessibility or freedom from barriers;
- Appropriateness as regards the cultural framework and the learner;
- Accreditation, at least in the country of origin;
- Affordability for all;

There is also a debate in regards open access publishing. A problem exists with repositories, which charge researchers a subscription fee or demand payment from users, representing a monetary restriction with respect to freedom. Although some publishers have begun to offer academic articles free of charge, their commercial model is controversial, since in order to maintain themselves they collect payment from authors for the right to be included in the repository. Claims made against collection of payment from researchers and/or the public state that such payment reduces the budget available to researchers to pursue their studies for the benefit of the public and that academic research is financed by the taxpayer or by charitable institutions, thus, they have to be open for public use (Parliament-UK, 2013). In this regard, in February 2013 a memorandum was issued by the Office of Science and Technology of the White House stating that all research funded by the US government would be of the open access type (Whitehouse, 2013).

As stated, open access publishing refers to access to academic research materials via the Internet, such that they are freely available to all for perusal and use. OER, in contrast, refer to free access to learning and teaching materials. There is clearly an overlap between the two types of material, since research articles constitute an integral part of the learning materials that students need to access for the purpose of their studies. However, attention must be paid to the difference between them, since what is involved is different nuances regarding licenses (Suber, 2012). Articles that refer to research studies also serve as learning materials, albeit different from learning materials that are developed by educators, these articles are not intended to undergo adaptation and modification but are to be preserved with their exact original content. Thus, they are copyrighted with "all rights reserved", as opposed to OER, which are copyrighted under CC, for instance, where only some of the rights are reserved (see Appendix B). In order to distinguish between these two kinds of access they are referred to as *Gratis*, i.e. free of charge and all rights reserved, and *Libre*, i.e. free of charge and only some rights reserved, as in OER (Suber, ibid).

Returning to the second word in the term 'Open Educational Resources', the meaning of the word 'educational' is also a source of argument – does it refer only to materials that are intended to serve in formal education or also to those used in informal education? As a possible compromise it may be stated that all material that in practice serves the purpose of learning can be included under the heading of 'educational' (Wiley, 2010a).

The term 'resources' too seeks a consensus regarding the type of materials that are included – does it refer to materials that are represented in all possible media, including print, or only to those in specific media? Today, it is commonly accepted that the reference is to digital resources. It is possible, in addition, to differentiate between source providers, these being academic institutions, educators and other members of the community (McAndrew, 2006).

The concept of OER has various implications for the educational system from the legal, financial, technological or pedagogic administration points of view (Glennie, et al., 2012). In the face of the potential advantages and the hopes that are pinned on the OEM, it is not possible to ignore the concerned voices that are being heard from many members of the academia regarding the different aspects of using OER in HE. These concerns relate to several contexts.

2.1.3.1 Educational concerns

In the educational context, no consensus has been reached in the academic world regarding the benefit of OER for learning. The expectation of the change that will be brought about by OER, is in fact, based on the assumption that all potential learners will benefit to the same extent from the same learning materials, even though from this point of view too, the findings are mixed (Christiansen and Anderson, 2004; Kay and Knaack, 2008). Knox (2013) states that open access to learning materials constitutes a danger to education itself, since there is no agency responsible for learning and no one to define the learning framework and structure. The implicit assumption in the OEM is that learners are self-directed and know how to manage their own learning, an assumption that is not necessarily correct (Leathwood, 2001; 2006). Knox (2013) expresses his concern over the fact that the OEM ignores the role of the teacher in the learning process.

2.1.3.2 Cultural concerns.

As of now, most OER are in English and are produced in the West (Glennie, 2012), a fact that raises the threat of cultural and linguistic hegemony. Bates (2011), in his blog post claims that open learning materials such as MIT OCW (MITOpenCourseware, 2013) or (Udacity, 2013) smack of elitism and imperialism. In his opinion, if MIT really wanted to assist the educational system, say in Africa, it should involve educational representatives from Africa, who would be engaged in the process of developing and creating learning activities that would be suited to the local culture. Richter and McPherson (2012) agree with him and emphasise that free access cannot overcome cultural barriers like lack of basic skills and language. Language barriers were also reported in relation to the Russian

(Knyazeva, 2010), Italian (Banzato, 2012) and Chinese (Huang, Lin and Shen, 2012) communities. Indeed, in recent years, efforts are being made to translate and adapt OER to local conditions and to the cultural context in which they will be reused and in parallel, there has been an increase in the production of OER in languages other than English (Cobo, 2013).

2.1.3.3 Evaluation of quality

One of the problems relating to OER is the determination of who is responsible for the quality of the learning material. There is no agreed solution to the problem, since learning materials exist on different levels and contexts (McGill, 2013). Thus, very often this assignment is incumbent on the teacher or the institution making use of them, relying on their own judgmental abilities alone. In any case, an argument still rages over uniform OER evaluation criteria because of the enormous range of learning materials and the fact that OER are published by a large number of agencies.

The need for such an evaluation mechanism is considerable, since learning materials are intended for reuse and without some certainty on the part of educators that the materials are indeed good, their reusability would be in doubt. Moreover, since a vast repository of OER materials exists, if it were possible to rank them according to quality, educators would be able to narrow down their search to focus only on high quality materials (Kay and Knaack, 2008; 2009).

It is a common practice to determine the quality of the learning materials by the association of these materials with specific academic institutions. For example, in OER that are produced by MIT (MITOpenCourseware, 2013) or Udacity (Udacity, 2013), the fact that these materials are connected with recognised academic institutions is strongly emphasised as a guarantee of their quality. However, a study conducted by JISC (2009) shows that many academic institutions prefer to choose their own learning materials based on personal recommendations from peers or their own academic judgment. Trying to solve this issue, the OPAL project has recently been set up by the Hewlett Foundation, focusing on the evaluation of OER quality throughout the world (OPAL, 2011). Additionally, UKOER program also provide evaluation support for projects and OER development and release (McGill, 2013).

2.1.3.4 Students' evaluation

In most cases the students lack an evaluation mechanism through which they can assess the knowledge they have acquired through the OER (Wiley, 2011) and this constitutes an obstacle for the independent learner, who is not associated with any academic institution. Moreover, Macintosh, Mcgreal and Taylor (2011) claim that free learning without an institutional framework cannot be evaluated or recognised officially, which is why it is important that use of OER take place within an institutional framework and not as free learning for all. In fact, a new initiative, known as OER for Assessment and Credit for Students by the Technology Enhanced Knowledge Research Institute (TEKRI) at Athabasca University, intends to create flexible ways for students to use OER in order to gain academic recognition for their studies from institutions of HE (Macintosh, Mcgreal and Taylor, ibid).

2.1.3.5 Lack of awareness

An additional question that is asked is whether free access to information is sufficient to meet the goals of global education and economic well-being as promised by the OEM (Atkins, Brown and Hammond, 2007; Caswell, et al., 2008; Daniel and Killion, 2012). Apparently, despite the potential contribution to teaching, there are still obstacles that have to be overcome in the process of OER assimilation. The principal difficulty is rooted in the little use that is made of them relative to the investment in open content by teachers and educational institutions (Korsgaard-Sorensen, Conole and Harlung, 2011)

There are still no massive inroads being made by OER into the HE system and awareness is insufficient. Therefore, these learning materials have not yet impacted the HE system in any significant way (Kortemeyer, 2013). Some of the reasons being: Difficulties in locating these materials on the Web; The spirit of openness has not yet spread to HE and not many educators are willing to contribute their learning materials for free use online; Uncertainty regarding the limits of openness, i.e. will students have access to exams, homework and solutions to exercises? (Kortemeyer, ibid); Users lack advanced skills in searching, selection, evaluation and adaptation of OER and the lack of knowledge is also manifested in the interpretation of the various licenses, which is the reason for the apprehension felt by potential users that they will violate copyrights (Volungevičienė, Lydeka and Mejerytė – Narkevičienė, 2012). Moreover, Educators still avoid sharing their learning materials with their peers for fear of criticism.

It is worth noting, that even in MOOCs (Massive Open Online Courses), where use of OER would be expected, there is still no mass enthusiasm. Although, MOOCs are open in the sense that they are freely available, most of the materials now used in these courses are the product of course developers and are protected by copyrights and thus, cannot be repurposed (Kortemeyer, 2013).

2.1.3.6 Copyright licensing

What essentially distinguishes OER from other open access learning materials is the question of license (Hilton III, et al., 2010; Wiley, et al., 2012). These are learning materials that are disseminated under license, enabling reuse and perhaps also adaptation without the need for permission from the copyright owner. In order for this initiative to be sustainable, there is a need to protect the intellectual rights of producers of learning materials, find the right incentives to encourage educators into creating such materials, learn what barriers prevent them from doing so and improve conditions for users to access the materials without the fear of violating copyrights (Creativecommons, n.d.), see also, Appendix B.

2.1.4 Learning Objects

The aim of this section is to clarify the term 'learning objects' (LOs) the learning units of which OER is comprised, as part of the practical aspect of the present research. The MM study materials that were used in the research serve as LOs via the websites of ***Computer Literacy*** courses in the college in which the research was carried out and could, potentially, serve as LOs in external repositories for use by other lecturers. It is therefore, important to examine whether in the context of blended learning, exposure of students to auxiliary materials that include narration by an unfamiliar lecturer affects their learning.

2.1.4.1 Defining learning objects

Ever since the term 'learning objects' was first introduced (in the 1990s), a number of different names have been suggested, among them: 'knowledge objects' (Merril, 1998), ‘instructional objects’ (Gibbons, Nelson and Richards, 2000), ‘learning objects’ (South and Monson, 2000; Bannan-Ritland and Dabbagh, 2002), ‘shareable content objects’ (ADL, 2001) and ‘resources’ (Hannafin, Hill and McCarthy, 2002). There is still no consensus regarding an exact definition that would capture the essence of the concept. Most of the definitions are blurred and in fact tend to generalise any learning entity, whether in digital or other format, that focuses on a single learning goal and that can be used for the purposes of study and exercises (Friesen, 2001).

With the development of ICT and following the definition of the LO Metadata Working Group of the IEEE Learning Technology Standards Committee, LOs have come to be commonly referred to as digital units that can be reused for learning purposes and accessed via the internet. At present, attention is focused less on the search for an exact definition of LOs and more on how they can be applied to intensify the learning experience (IEEE, 2002a; Boyle, 2003; 2006).

The definition, to which the present research referred, dwelt in narrated MM learning objects, or more specifically, Narrated Video Screen Captures (NVSCs). NVSCs deal with a nuclear learning subject (examples of a nuclear subject include insertion of an image in a MS Word™ document or definition of tabs in a MS Word™ document etc.).

2.1.4.2 Learning object repositories

The penetration of LOs, as part of the OER movement, was made possible with the spread of online education and the developing appreciation of the need for constructing repositories of online learning materials. These repositories, thus, came into being as early as the 1990s (Duval, et al., 2004; Brown and Adler, 2008). At present, tens of LO repositories exist, as well as numerous meta-repositories supporting them (Macintosh, Mcgreal and Taylor, 2011), see Appendix C. From the point of view of this research, what these repositories allow is a mix of different lecturers and voices that are not necessarily known to the learner, as part of the course learning material.

2.1.4.3 Narrated video screen captures as learning objects

This research made use of NVSCs, also known as video screen casts, vodcasts or podcasts, which are asynchronous MM units that serve for demonstration, remote technical assistance and guidance. In recent years, the usage of this technology is growing considerably in HE (Salmon and Edirisingha, 2008; Guertin, 2010; Swan and Hofer 2011).

NVSCs are recordings of the computer on-screen activity including mouse movements and clicks, which may include the instructor's narration. These video files can be incorporated in learning and guidance environments, providing learners with personalised content in the framework of a specific course (Peterson, 2007; Bergman and Sams, 2008; Richardson, 2009). Since the NVSCs may include the lecturer's voice, they are of a more personal nature. In certain situations, however, inherent in the system is a potential disadvantage. The possibility exists that when the narrator's voice is unfamiliar to the student, interference will take place in the learning process, given the assumption that the students are studying the subject with the help of a teacher with whom they have face-to-face sessions and that the MM material serves them for the purposes of revision and supplementary learning.

For use as auxiliary materials in the ***Computer Literacy*** course, short NVSCs were produced in order to help the students revise the material and procedures learned in the class lesson. The purpose of the NVSCs is to enable visualisation, which is more difficult to achieve in a textual format, even if it is accompanied by a large number of screen images (Mount and Chambers, 2008).

The above gave rise to the question: Is it important that students listen to NVSCs with narration in the familiar voice of the course teacher or is it possible to use NVSCs, found in LO repositories, featuring other teachers and can these captures serve students of other lecturers without it impairing their learning?

It should be mentioned that during the period of the research the NVSCs were uploaded only after the last experiment had ended and in the meantime, the students used other kinds of reference materials in order not to disrupt the experiments. However, the NVSCs were uploaded to the virtual learning environment enough time before the examinations, so that they could use them for their preparations (see Appendix D for details on the production of NVSCs).

2.1.4.4 Criticism of learning objects

Despite the enthusiasm surrounding the concept of LOs in teaching, there is also a criticism of the trend (Salajan, et al., 2009). Scepticism is being heard of the entire notion of incorporating LOs and enabling their mobility from one field of knowledge to another, claiming that LOs can be taken out of context if integrated into different fields of knowledge. Not many research papers exist to confirm that intensified use of LOs advances and contributes to learning (Duval, et al., 2004). There is a lack of research that examines design guidelines ensuring that LOs are indeed effective and facilitate efficient learning (Knox, 2013). An examination of the usefulness can be performed from a number of aspects. The present research examined the aspect of familiarity with the narrator, since it is possible that the incorporation of LOs in blended learning adds a dimension that does not exist in purely virtual learning, namely, the element of face-to-face familiarity with the course teacher.

Very little research has been identified that studied the educational aspects of LOs intended for widespread use by users throughout the world in different contexts (Nurmi and Jaakkola, 2006; Friesen, 2009). Like all learning materials designed by instructional designers, it may be assumed that LOs too are produced based on established design principles. However, learning materials that are intended for use by a varied population in different contexts require slightly different thinking, taking into consideration the cultural, the contextual and individual differences (Rehak and Mason, 2003).

Personalised learning is a primary value in education, irrespective of the educational model involved (Gibbons, Nelson and Richards, 2000; Nurmi and Jaakkola, 2005; Heller, et al., 2006; O'Keeffe, et al., 2006; Türker, Görgün and Conlan, 2006). Indeed, in recent years there has been an increasing trend towards personalisation of LOs for the learner. Programs and platforms have been proposed recently, that enable automatic selection of the sequence of LOs or a sequence according to the learners' choice. Nevertheless, this selection is mainly in the context of their previous knowledge of the subject matter (Rumbaugh, et al., 1991).

An additional issue of concern is the personalisation of learning using LOs, stemming from the manner in which they are tagged by their producers – one that is highly rigid and that adheres to predetermined criteria (IEEE, 2002a). Such a strict method of tagging does not allow the users to add their own tags and navigate their way between LOs according to their own preferences (Shirky, 2009).

Whereas some research claims that LOs are in fact building blocks with which the learners construct their knowledge (Hodgins, 2002; Norman, 2004; Downes, 2007a), Wiley (2004) states that there is an inherent problem regarding the requirement for reusability in what he refers to as the 'reusability paradox'. Wiley argues that part of the requirements regarding reusability with LOs is the possibility of incorporating them in reuse in all contexts and in any required order. For example, in the matter of personalisation, the more granular the LO is, the higher the possibility that it will be reusable and greater reusability enables greater personalisation (Dharinya and Jayanthi, 2012). However, what emerges from this requirement is that LOs should preferably not include any context, for otherwise it will not be possible to incorporate them in other contexts. This is paradoxical, since in order for learning to be effective, it is important that the learning materials be contextual to the material being studied, e.g. the text should make reference to previous material studied with respect to a culture or current event that has occurred. Thus, on the one hand, it is desirable for the learning to be authentic, but on the other, there is the requirement that LOs be reusable and suitable for every context – the two factors contradicting each other (Wiley, 2004).

Furthermore, there is the expectation that it will be possible to incorporate LOs automatically in different learning conditions (Gibbons, Nelson and Richards, 2000). On the other hand, however, when the LOs are small and granular, as suggested, automatic incorporation is not possible and a skilled teacher is needed to integrate them, such that they will be of significance for learning. According to Wiley (2001), a possible solution is to adopt the constructivist approach and allow the students interaction with the learning environment, enabling them to choose LOs that are suited to them, as done by Mason, Pegler and Weller (2005).

In a study conducted by Mason, Pegler and Weller (ibid), a successful online course was designed based entirely on reusable LOs, which were context free, using one non-reusable LO at the beginning of each unit for introducing the contextual background and 'gluing' the reusable LOs together. The LOs used were developed with internal integrity, thus, allowing the students personalised learning, since they could use them in accordance with their personal preferences. However, it should be noted that all the LOs were developed by the same people and they were reused by the developers in the same institution.

In addition, there is another problem for the learner with the approach relating to automatic personalisation of LOs (Sunstein 2007; Pariser 2011). When personalisation relies on the history of the learners' interests, it limits their personal growth, since they will always be referred to similar content. Learners should be expected to develop interests in ways that are unrelated to their search for LOs, e.g. through social links, an attribute that is not seen in automatic personalisation. Likewise, since each learner could have different and varied fields of interest that are not necessarily interrelated, personalisation should be made possible according to his/her preferences (Dharinya and Jayanthi, 2012).

Developers of the object-oriented programming technique also admit that this technique is not a magical recipe for reuse of objects. Reuse must be intelligent and planned and must take into account impacts that are beyond the immediate application of the objects (Burbules and Callister, 2000). In other words, the problem is not only technical and it is important to bear in mind at all times that the educational effort is composed primarily of the human dimension, thus, educational considerations should be used taking into account students' various needs and preferences. This problem can be solved by enabling adaptation of the LOs both by means of a suitable license, with suitable software and by requiring that the LOs be in an open, editable format. In fact, in recent years a more flexible kind of LOs was suggested, namely, Generative Learning Objects (GLOs), which allow instructors the adaptation of their content as necessary (Boyle, 2003; 2006). The adaptability feature of the GLOs allows them to be reused and recombined in several contexts as necessary, using a dedicated software, namely, GLOMaker (GLOMaker, n.d.), which was developed by the Centre for Excellence in Teaching and Learning in Reusable LOs (RLO-CETL). The structure of the GLOs is based on a separation of the GLO's template from its content and a repository of free accessed GLOs is available for instructors to download, adapt and reuse (RLO-CETL, n.d.). An additional problem related to LOs is the lack of updating of materials. World knowledge is being rapidly updated and reuse of LOs could expose the learner to information that is not current. Again, this deficiency can be tackled using GLOs, which can be modified and updated as necessary using authoring tools (Kinshuk and Jesse, 2013; GLOMaker, n.d.).

Practically no reference was found in the literature to the fairly reasonable possibility that LOs that are gathered from repositories on the web can include narration by different lecturers and what influence this could have on the student. That is especially important in a situation similar to the one addressed in this research – i.e. one of blended learning, in which the students know the lecturer on a personal level through weekly sessions.

To summarise, section 2.1 described OER and the debates relating to them. Also discussed were MM learning materials of which use has been made in the research, the context to which they belong from the point of view of educational technology and the questions arising out of their use with regard to the affective aspects of learning.

Remaining in the domain of the context of the research, the next sections will define instructional design, Human Computer Interaction, digital literacy and the educational approach that was adapted during face-to-face sessions in the framework of the ***Computer Literacy*** course.

2.2 Learning theories and instructional design

In order to relate to LOs from the perspective of instructional design, reference will be made to the classic approaches to learning and teaching, since learning theories can provide the theoretical background on which instructional design is based (Merriam and Caffarella, 1999; Merril, 2001b). Instructional design of LOs is mostly based on classic learning theories, i.e. *behaviourism*, *cognitivism* and *constructivism* (Churchill, 2007).

Behaviourism focuses on the objectively observed behavioural aspects of learning and disregards any unobservable activities of the mind. According to the theory, learning is a process involving response to external stimuli. Theoreticians associated with behaviourism are Pavlov, Skinner, and Watson (Ormrod, 2008). According to behaviourism, memory is a product of recurring experiences, the most influential of which are stimulus and response. Learning of this nature is not considered to encourage high-order thinking and the types of learning that are most effectively explained by means of this theory are rote learning and drill and practice.

Thus, LOs based on behaviourism, contain functions of feedback that provide information on the progress of the learners and allow them to advance in accordance with their observed achievements (Krauss and Ally, 2005; Nugent, Soh and Samal, 2006).

Unlike behaviourism, cognitive learning theory deals with internal processes that take place in the learner's brain and attempts to explain how these processes can support effective learning. Cognitive theory states that learning is a process of acquiring and storing information, i.e. it regards learning as an active internal cognitive process that takes place in the learner's brain.

Theoreticians identified with the theory of cognitivism are Atkinson, Shifrin and Baddeley (Ormrod, 2008). According to the cognitivistic theory, in order for learning to take place, the learner needs to have prior cognitive structures that allow him to process new knowledge; these structures are activated automatically the moment there is a need to learn new knowledge. In other words, the factors influencing learning are the existing cognitive schemas and the learner's previous experience. The role of memory in learning, according to cognitivism, is coding and storage and the types of learning that are explained by the theory are reasoning and problem solving (Ormrod, ibid).

Learning Objects based on cognitive learning theory, contain options that are intended to activate the learner's previous knowledge and embed information in the long term memory by supplying background information and demonstrating the relationships between important concepts. The latter are enriched by visuals and MM in order to activate as many parts of the brain as possible (Krauss and Ally, 2005; Nugent, Soh and Samal, 2006). In LOs that apply cognitivism the learner is relatively more active and is required to engage in problem solving (Bradley and Boyle, 2004; Krauss and Ally, 2005; Farrell and Carr, 2007), as well as self-reflection (Krauss and Ally, ibid; Farrell and Carr, ibid).

Both behaviourism and cognitivism are theories of an active nature: there is a prior definition of the learning goals and ultimately objective measurement of the learner's knowledge based on these goals. Derived from the cognitive theory, is *social cognitive theory*, which focuses on learned skills, acquired by observing others in social interactions. This theory also emphasises the importance of developing students' self-efficacy via role modelling (Bandura, 2001; Ormrod, 2008).

Being targeted at knowledge transmission, many LOs are designed using the behaviourist and cognitivist learning approach (Bannan-Ritland, Dabbagh and Murphy, 2002; Wiley, 2003), an approach which is being criticised as being reductionist and which conflicts with more recent learning theories (Nurmi and Jaakkola, 2005).

Constructivist theory, as opposed to behaviourism and cognitivism, fosters a subjective learning experience, with the learning approach differing from one learner to the next and in which the final results are not easily measured. Constructivism focuses on developing a conceptual understanding and on the process in which students learn by constructing their own model of the information rather than being provided that information (Brown, Collins and Duguid, 1989; Renkl and Atkinson, 2007). Theoreticians associated with the theory are Dewey, Piaget and Vygotsky (Ormrod, 2008).

According to constructivism, the role of memory in learning is integration of previous knowledge with new knowledge. The types of learning explained by the theory are experiential self-learning, directed learning and problem solving (Ormrod, ibid). Derived from constructivism is *social constructivism*, which is based on constructivism but places greater emphasis on the social aspect of learning. According to this theory, learning is a process of constructing knowledge, with teachers being the cognitive instructors and learners deriving meaning from the teachers' instruction (Vygotsky, 1978; Woo and Reeves, 2007).

Some part of LOs design is based on constructivist theory and implementation is manifested, among other things, by personalisation, i.e. allowing the students control through selection of preferred options such as learning order and pace (Bradley and Boyle, 2004; Krauss and Ally, 2005; Mason, Pegler and Weller, 2005; Lim, Lee and Richards, 2006; Farrell and Carr, 2007), or allowing them to choose their own preferred learning strategies (Cochrane, 2005; Lim, Lee and Richards, ibid; Farrell and Carr, ibid).

Criticism has been voiced in connection with instructional design of LOs, directed at the fact that many of them are based on outdated teacher-centred learning theories, involving drill and practice and do not apply more recent learning theories such as those based on constructivism (Merril, 2001a; Dodds and Fletcher, 2004; McCormick, Jaakkola and

Nurmi, 2008). Despite this, it is important to note that in certain cases this instructional approach is appropriate (Jaakkola and Nurmi, 2008). Moreover, according to Merril, et al. (1996), the instructional design of LOs should be neutral, allowing the teacher to decide whether to incorporate them in teaching methods that are behaviouristic, cognitivistic or constructivistic.

The previous paragraphs presented a review of classic and established learning theories. Following is a review of a more modern learning theory oriented to online learning, i.e. *connectivism*. Connectivism is a relatively new theory that is still in the process of formation. According to this theory, which was first proposed by Siemens (2005) and Downes (2005; 2007b), learning is a process of linking up to information sources and the learners construct their knowledge actively, based on their personal experience. Learning is complex, rapid, drawn on a variety of information sources and includes integration of previous knowledge, experience, perception, understanding and flexibility. Connectivism is based on social constructivism (Siemens, 2005) and suggests that learning is transferred online, is social and is supported by technology. According to this theory, the factors influencing learning are the range of networks available and transfer occurs by the addition of nodes to existing knowledge.

Connectivism claims that knowledge is scattered throughout the information systems and is stored in a wide range of digital environments and networks. From the point of view of connectivism, learning begins the moment the learner connects to a learning community in the network and collaboratively creates new information links (Kop and Hill, 2008). Thus, the entire concept of OER is based on the theory of connectivism as part of the OEM. Being a new theory, there is still much debate around connectivism some accusing it of not being a real theory but rather a learning approach to teaching and learning in the 21st century (Kop and Hill, ibid), while others refer to it as a new learning theory (Loureiro and Bettencourt, 2010).

Another, relatively, recent instructional design theory is Cognitive Load Theory (CLT), which emerged in the late 1980s as a psychological learning theory that focuses on the unobservable aspects of learning, i.e. cognitive load (Plass, Moreno and Brünken, 2010). The conceptual framework of CLT was found to be the most appropriate for the present study, since it focuses on research-based instructional design, aimed at facilitating acquisition of knowledge in well-structured learning environments, by reducing unnecessary cognitive load (van Merriënboer and Sweller, 2005; Paas and Sweller, 2012). This suits the context of the research, which employed NVSCs in the format of worked out examples, also called example modelling (Atkinson, et al., 2000; van Gerven, et al., 2002; van Gog, Paas and van Merriënboer, 2008; Gee, 2010). These MM learning materials are in the 'how to' style and include step-by-step procedures of how to perform the various commands of specific software, using these learning materials. The present research aimed to find out the influence of familiarity with the narrator on learning, from the perspective of cognitive load. CLT underpins the instructional design theories on which this research hypotheses were based. Thus, it will be elaborated on in Chapter 3, together with the other theories derived from it.

2.3 Human-Computer Interaction (HCI)

Human-Computer Interaction is a multidisciplinary science (Carroll, 2003) that deals with interaction between humans and computers. This can be considered from the viewpoint of human factors, which focus on the compatibility between man and machine from the ergonomic aspect or from the aspect of cognitivism and information processing, which try to explain the effect of information presented in the computer and processing of the information by the human brain (Grudin, 2005). From the point of view of human factors, HCI is a discipline whose aim is to consolidate understanding and design of different man-computer interfaces such that the interaction between the two is pleasing, while being accessible in terms of functionality and usability. Functionality is defined as the set of actions or services that are intended for the user; usability complements functionality and is defined as the level at which the system can serve the user efficiently for carrying out the actions defined in the functionality of the system (Gupta, 2012). From the cognitivistic point of view, HCI is a discipline that tries to find ways to improve the efficiency of information transfer (Grudin, 2005) and this approach to HCI is interesting in the context of the present study, which concerns MM learning. Tutorials that are used for study are compatible with the cognitivistic perception, representing the connection between information transfer and study, although information transfer alone still does not explain how learning takes place. The metaphor of cognitivism describes the human brain as an information processor. Thus, cognitivists ask: How do humans process the information they receive? How is information represented in the brain? How do they retrieve information from memory (Mayer, 1996)?

Therefore, one of the subjects addressed in research on HCI from the cognitivistic point of view is the mental model of the users when they receive information from the computer (Payne, 2009). Mental models are used to describe different aspects of mental representations that are constructed by the user during interaction with the computer, when the information that is transferred can be of different types such as text, images, etc. Mayer (2005a) investigated the impact of MM on construction of the mental model and proposed the Cognitive Theory of Multimedia Learning (CTML, elaborated on in section 3.2), based on Cognitive Load Theory (CLT) (Sweller, Van Merriënboer and Paas, 1998), elaborated on in section 3.1. In fact, in recent years, CLT influences a large part of HCI research (Rogers, 2004).

Usability is a central concept of HCI (Chalmers, 2003; Sharp, Rogers and Preece, 2007) and a major goal of usability design is the decrease of cognitive load for users (Preece, Sharp and Rogers, 2002; van Nimwegen, et al., 2006; Sharp, Rogers and Preece, 2007). However, increased usability, which is desirable in technology used as productivity tools, can sometimes have a negative impact when educational technology including learning activities is concerned (Tselios, Avouris and Komis, 2008). According to these authors, usability in learning systems should be judged beneficial only if it contributes to the process of learning and not if it just supports efficient task execution, because high level of effectiveness and efficiency does not necessarily contribute to learning outcomes.

When comparing CTML instructional design principles (Mayer, 2005a) to usability goals and principles, it appears that some of these principles have been applied in software design in similar ways. This applies specifically to the *modality principle* (van Gerven, Paas and van Merriënboer, 2006), *split attention principle* (Ayres and Sweller, 2005) and the *redundancy principle* (Moreno and Mayer, 2002; Sweller, 2005b), see section 3.2.

The main concern of HCI in regards to usability is decreasing extraneous cognitive load (see section 3.1.2.2). Moreover, CLT's principles have been explicitly integrated into HCI research. Chalmers (2003) mentioned these principles for decreasing extraneous cognitive load as a means of increasing the usability of educational learning environments. Oviatt

(2006) applied usability principles, such as making a system more intuitive and easy to learn in order to decrease extraneous cognitive load and Sawicka, Kopainsky and Gonzalez (2008) suggested that designing usable educational systems reduces extraneous cognitive load and may contribute to improved learning. According to them, cognitive load may be induced by using poorly designed software and/or by poor instructional design.

Reeves and Nass (1996) who suggested the ***Media Equation Theory,*** claim that the user regards the computer as another human being and therefore, anything on the computer screen, whether it is a figure, colour, sound or voice, can elicit an emotional response. This theory has been refined as ***Social Interface Theory*** in HCI (Dryer, 1999) and as ***Social Agency Theory*** (Mayer, 2005b) in MM learning (see section 3.4). As can be seen, there is a close connection between HCI and cognitive science, with the relationship being in a one way direction with cognitive science contributing to HCI. A new approach was introduced by Boring (2002) who suggested to look also at the contribution of HCI to cognitive science by offering the cognitive science application and helping it to become an applied research by taking the cognitive research out of artificial laboratory settings and connecting it to the external world. The author claims that cognitive science will benefit from HCI not just by applying its theories to HCI research, but by allowing new theories to stem from applied HCI research.

In recent years, recognition has grown of the relationship between humans, computers and emotions (Picard, 1997; Norman, 2004; Brave and Nass, 2009; Nass and Yen, 2010). The suggested terms, ‘affective computing’ (Picard, 1997) and ‘emotional design’ (Norman, 2004) refer to the integration of emotions in HCI in an attempt to make computer systems more natural for users to understand and use (Picard, 2003). These researchers also refer to HCI from the cognitivistic point of view, but they speak of the connection between what is presented by the computer and emotions (fear, happiness, sadness, anger and disgust), as well as the implications regarding human cognition. CLT assumptions contribute to affective computing as well, since cognitive load from whatever reason, during the interaction with the computer, may affect the user’s affective states (Kalyuga, 2011b). According to Brave and Nass (2009), any interface that ignores the issue of the user's emotion can dramatically sabotage interaction.

In the case of HCI which incorporates voice, reference is often made to interactive voice-controlled technology and to systems that are able to recognise voice and carry out actions based on voice commands given by the user (Gamm and Haebumbach, 1995; Horvitz, Jacobs and Hovel, 1999; Sawhney and Schmandt, 2000; Schmandt, et al., 2000; Wilson, 2000). Voice recognition systems may be exemplified by Apple's 'Siri' (Apple, n.d.), the Google Voice Search in Google Chrome (Google, n.d.) and recently, a technology has been developed, where computers recognise affective cues given off by the user and adapt the interaction accordingly (Nass and Brave, 2005; BeyondVerbal, 2013). However, what is interesting from the point of view of the present research is the effect that a voice emanating from the computer has on the user. Computer systems can play verbal and non-verbal sounds that accompany interaction with humans, such as the beep announcing an erroneous action, the tone heard when mail is received, etc. Instructional software may also benefit from such non verbal sounds as research found that sounds can help learners see interconnections among pieces of information they get by relating new information to existing knowledge (Bishop, Amankwatia and Cates, 2008). However, these findings are in opposition to the argument made by Moreno and Mayer (2000) that extra sounds, 'bells and whistles', as they call it (p. 117), inhibit learning in MM learning by exerting a cognitive overload (see *coherence principle*, section 3.2). Nevertheless, the present research focuses on the voice that is heard during interaction with the computer. According to Nass and Gong (2000), when computer software includes speech, whether from figures on the screen or otherwise, this speech can elicit a sense of social interaction. Moreover, research shows that voice characteristics influence the listener's perception of the speaker and thus have an impact on interactions between people and between people and computers (Pittman, 1994; Truax, 2001; Nass and Brave, 2005), see section 3.5.

There is a need to distinguish between commercial/marketing applications and educational applications. In educational systems, research shows that the human voice helps learners feel the presence of the teacher (Kim, 2005; Ice, et al., 2007). MM learning materials allow the display of verbal information (in textual or audio form) and static or animated images and since the incorporation of these materials in teaching has become commonplace, importance is attached to their proper design (see CTML, section 3.2).

2.4 The Adult learner

The aim of the present section is to characterise the research population and justify the pedagogic approach used during the ***Computer Literacy*** classes, in spite of the fact that the students were adults.

2.4.1 Definition of the adult learner

Since the student population in the research is non-traditional with an average age of 24.5, ranging from 19 to 45 (see section 1.2 and Table 4-3), it was found suitable for examining definitions and educational theories that address the adult learner. There is no consensus in the literature regarding the definition of the adult learner. Should they be defined according to their age or other characteristics that could be more significant for learning than their very definition as 'adults', such as culture, personality traits and life experience (Cercone, 2008)? According to Knowles (1980), reference should be made primarily to the psychological definition of the adult 'me', which states that adults are considered such the moment they perceive themselves as responsible for their own life. Secondly, reference should be made to the social definition, which places the emphasis on social roles that the person fills, as accepted in the society in which he/she lives. In western society the reference is to work, married life, parenting and acting as a responsible citizen, doing one's military service and fulfilling any other social requirement that the society in which the person lives views as necessary.

Cross (1981) suggested a 'characteristics of adults as learners' model, which relates to two variables in connection with the learner: personal traits and situational traits. Personal traits include the age of the learners and its implications with respect to their cognitive capabilities, life cycles and the development stage (marriage, work changes, retirement) and their implications with respect to the learner. Situational traits are composed of part-time *versus* full time studies and voluntary *versus* imposed studies. According to Darkenwald and Merriam (1982), people are considered adults at the stage at which they already meet other social obligations such as work, married life and parenting. Forrest and Peterson (2006) agree that the question of age is arbitrary and is not significant in determining whether a person is an adult or not. According to them, the factor that does determine this is the social obligations he/she assumes.

The present research dealt with students in a private college in Israel. These students, as found from the socio-demographic survey (Appendix E second part) that was conducted and described in section 4.8 of this thesis, are non-traditional (see section 1.2) and also fit the adult student definition as presented here. What distinguishes these students from traditional students in particular are the additional obligations that the former have (Byrd, 1990; Mabry and Hardin, 1992; Forrest and Peterson, 2006). These obligations cause students to absent themselves from the regular lessons, so that even though the courses offered in the college are traditional and frontal, the students are often faced with the need for independent distance learning in order to catch up material they have missed.

2.4.2 Educational theories addressing the adult learner

Educational research presents two models that describe how people study: *Pedagogy*, derived from the Greek 'child-leading' and *andragogy*, derived from the Greek 'man-leading'. *Andragogy* tends to be more learner-focused while *pedagogy* is more teacher-focused (Knowles, 1980; Birzer, 2004; Conner, 2004; Thompson and Deis, 2004; Ozuah, 2005). The present research deals with adult students, thus, it is only natural to explore theories of adult learning. However, as will be explained, the educational model that was found to be most appropriate here was the pedagogic one.

The theory of andragogy contends that educational theories that are suited to the young learner do not fit the requirements of the adult learner (Knowles, 1984; 1990; Birzer, 2004). The assumption is that adult learners' traits are different from those of young learners and this being the case, theories have been developed over the years that have addressed learning by adults, aimed at answering the special needs of adult learners. Accordingly, it was deemed proper to relate to these theories in the research.

For several decades, attempts have been made to define the characteristics of the adult learners and the instructional principles that would best suit them. The term '*andragogy*' was first suggested by Kapp (1833) but the theory he proposed met with severe criticism and was abandoned (Group, 1983). A theory relating to adult learning reappeared in 1921 by Rosenstock (Forrest and Peterson, 2006), but the most effective thrust in this context was provided by Knowles (1984). Knowles emphasised the rise in the number of adult learners in the HE framework and developed a statement relating to educational practice for adults while attempting to develop a comprehensive theory for adult education (Smith, 2002).

In recent years, andragogy has increased in popularity and many institutions have adopted the andragogical techniques for adult learners (Birzer, 2003). Andragogy focuses on two principle domains that centre on the adult learner: the psychological perspective and the social perspective. The psychological perspective of andragogy, based on the approach of psychologist Edward Thorndike, maintains that personality traits and differences between individuals influence the type of learning (Thorndike, et al., 1928; Thorndike, 1973). The social perspective, based on the approach of educator Eduard Lindeman, claims that adults need to learn through experience (Lindeman, 1926; Knowles, 1980; Knowles, 1984; Cartor, 1990).

Knowles, Holton III and Swanson (1998, p. 4) suggested six assumptions which are fundamental to adult learning:

1. *Self-concept*: Adults are self directed and resist situations in which they feel that others are imposing their opinion on them;
2. *Experience*: Adults have an accumulated life and professional experience that becomes a resource for learning;
3. *Readiness to learn*: Adults are willing and ready to learn anything that is relevant and will contribute to their social roles;
4. *Orientation to learn*: Adults seek immediacy of application of their studies, they are problem centred, i.e. they are motivated to learn anything that according to their perception will help them solve a problem in life;
5. *Motivation to learn*: Adults are internally motivated to learn;
6. *The need to know*: Adults need to know the reason for learning, i.e. only when they undertake learning they deem valuable will they invest effort;

A different perception of adult learning was proposed by Cranton (1994), who distinguished between three different types of adult learning:

- ***Subject-oriented adult learning*** – according to this approach, the principal aim in learning is to acquire knowledge in a specific subject. The role of the educator in this case is to 'cover' the required material in order for the learners to develop a skill in that field;

- ***Consumer-oriented adult learning*** – the main goal in this approach is to answer the needs that the learners express. The learners set their learning goals, choose their sources, etc. The educator serves solely as guide;
- ***Transformative adult learning*** – the aim in this approach is to free the learners of anything that limits their control over their lives. This type of learning leads to transformation in the perceptions of the learners through critical reflection (Mezirow, 1991);

Subject-oriented learning is the approach that was adopted in the ***Computer Literacy*** course referred to in the research. The main goal in the course is to acquire skills in the use of the popular MS Office^{TM} programs. The role of the teacher in the course is to impart to the learners the skills that will allow them effective use of the programs for the purpose of their subsequent academic work, as well as in the job market.

2.4.3 Criticism of adult learning theory

Over the years, criticism has been levelled at andragogy both with regard to being a scientific theory and with regard to the theoretical assumptions made by Knowles regarding the type of learning preferred by the adult learner (Boud, Keogh and Walker, 1985; Brookfield, 1986; Tennant, 1988; Brookfield, 1995). In addition, it has been alleged that the theory does not take into account the context of the field of knowledge being studied (Cercone, 2008).

Criticism has also been levelled at Knowles' definition of the adult educator. According to Callender (1992), Knowles' definition (1984) is too general and includes anyone who is engaged in one way or another in any kind of adult instruction, even without any previous training. In his opinion, the lack of professionalism with respect to these educators is what causes adult education to lose its status.

In this respect, Rachal (2002) agrees with Callender (1992) and claims that there is no clear-cut agreement regarding the significance of andragogy, both because of the researchers who attribute different meanings to it and because of the primary definition of the theory, which is very broad. Furthermore, Rachal points to the absence of clear procedures that constitute andragogical practice.

Callender (1992) also points to the paradox between the attempt to define adult education as a science and the role of adult educators. In referring to adult education as a research science one has to be as objective, unbiased and scientific as possible. What this implies is that those engaged in adult education as a science should not be involved in learning because their subjectivity is controlled in the time they spend in the field as researchers. Ironically, subjectivity and involvement are precisely the attributes needed from the adult learner. Thus, according to him, turning adult education into a science prevents educators from being adult learners themselves.

Additionally, it is claimed that andragogy is deficient in all matters relating to empirical evidence and therefore, lacks all the basic characteristics of scientific theory (Pratt, 1993; Brookfield, 1995; Rachal, 2002; Merriam, caffarella and Baumgartner, 2007). One of the reasons for the lack of empirical evidence is that, on the one hand, in order to examine the effectiveness of andragogy, the achievements of the learners must be measured on the basis of tests and grades, while on the other, tests and grades are means to which andragogy is opposed (Rachal, 2002; Heller, 2004).

It is also claimed that there is no significant difference between pedagogy and andragogy, that andragogy cannot be regarded as a stand-alone theory and that what makes adult learning different is the different situation in which adults find themselves (Knox, 1986; Jarvis, 1987; Merriam and caffarella, 1991; Mezirow, 1997; Merriam, 2001). That is, criticism of andragogy is directed mainly against the theory's focus on the development stage of the learner and on the assumption that the adult learner learns differently from the child, while there is insufficient reference to the connection between the learners and society and to the goals that they set themselves. Many critics maintain that not only does not much difference exist between the learning processes of children and adults, but in any event, it is not correct to treat the entire population of learners above the age of 24 as homogeneous, since in fact, what influences adult learning is personal characteristics: learning style, motivation, personality traits, environmental constraints, origins and gender (Kidd, 1978; Jarvis, 1985; 1987; Geber, 1988; Cassara, 1990; Ross-Gordon, 1991; Pratt, 1992; Hanson, 1996; Cranton, 2000; Perrin, 2000; Willyard and Conti, 2001; Pratt, 2002). Moreover, adult learners may belong to a mix of generations with different backgrounds, values and preferences, i.e. Baby Boomers, born between 1943 and 1960; Generation-X, born between 1960 and 1980; and Generation-Y (Millennial), born in the 1980s (Goldman and Schmaltz, 2006).

Jonassen and Grabowski (2011) suggested a typology of individual differences that could affect learning: they referred to the cognitive dimension, which included apart from cognitive capabilities also the personality dimension and prior knowledge. Brookfield (1995) claimed as well, that the interaction between emotion and cognition in adults calls for much closer attention and that it is very difficult to maintain with full conviction that a particular approach is the best for a particular population of learners solely according to their age. Tennant (1997) and Smith and Pourchot (1998) contended that it is psychology that should constitute the basis in adult education. Agreeing with them, Ashley-Baisden (2001) summed up her research with a recommendation that instead of focusing on demographic variables, future research must examine psychological variables and their influence on the learning preferences of adult learners.

One of the most important assumptions of andragogy, which received the closest attention of researchers, alleges that adult learners are interested in controlling their type of learning, are able to consider different learning strategies and seek the best strategy to suit their needs, i.e. self-directed learning (Knowles, Holton III and Swanson, 1998; Birzer, 2004). One of the prominent advocators of self directed learning who preaches for transforming the education practice in HE into 'engaged pedagogy' is bell hooks, an educator and a social-activist who calls for professors to abandon the power relationship between them and their students and allow them more control over their learning (hooks, 1994). However, she admits that students are not always ready for this kind of learning or as hooks explains it 'Since the vast majority of students learn through conservative, traditional educational practices and concern themselves only with the presence of the professor' (hooks, 1994, p.8). Other researchers agree that the degree of student's centred learning depends on many factors, among them the learners themselves, the subject being studied and personal variables (Merriam and Brockett, 1997; Merriam, 2001; Birzer, 2004).

In fact, research studies that examined what college students regard as effective teaching found that in most cases students preferred the teacher-directed approach (Donaldson, 1989; Flannery, 1991; Ross-Gordon, 1991; Haggerty, 2000). Indeed, the 15 most common characteristics that students view as being the most effective for learning are:

- The instructor should be knowledgeable in the subject matter;
- The instructor should be concerned about his/her students;
- The instructor should present the material clearly;
- The instructor should motivate the student to learn;
- The instructor should emphasise the relevance of the subject matter;
- The instructor should be enthusiastic;
- The instructor should encourage participation;
- The instructor should create a comfortable atmosphere;
- The instructor should be well-organised;
- The instructor should use varied techniques;
- The instructor should be responsive to different needs;
- The instructor should be available;
- The instructor should be open to questions;
- The instructor should be dedicated to teaching;
- The instructor should be warm; (Donaldson, Flannery and Ross-Gordon, 1993, p. 158).

It is apparent that all the above characteristics are associated with the lecturer only, emphasising the fact that despite Knowles' assumptions and despite the fact that self-directedness is a central assumption in andragogical theory, not all researchers endorse it. These findings, related to adult students' preference of the teacher-centred approach, especially when the subject matter is new to the students, are also supported by Young and Shaw (1999), Walkin (2000) and McCollin (2000).

Andragogy assumptions in relation to self-directed learning are also criticised by Leathwood (2001; 2006), who argues that the notions of independence, self-directed learning and autonomy in HE are gender and culturally specific, usually associated with middle class white males. Thus, they are inappropriate for the majority of students. Conner (2004), on the other hand, places herself firmly on the side of andragogy and claims that learning should be learner centred, not just with adults but with younger learners as well. She draws attention to Knowles (1984), who said that of the suggested principles of andragogy, only the principle which refers to previous experience and firm beliefs, refers only to adults, all the other principles may be attributed to children as well. Conner (2004) claims that this approach to studies is particularly important in the age of knowledge, when greater self-learning of new technologies is called for. According to her, learning that is teacher centred does not impart to the learners the skills needed for the acquisition of such knowledge themselves because of the acquired dependence on the teacher. With regard to the self-directed approach, Callender (1992, p.156) claims that it is more correct to refer to adult education as 'self-education' and emphasises that self-education is not self-directed. According to him, when the aim is development of an independent and curious learner it is not enough to be self-directing and motivated in a particular subject. A person must be open to all fields and there should not be a single subject that is out of bounds for learning purposes. There should not be any field about which a person can claim to know enough because such an assumption precludes self-education. This is true even if the person is engaged at the same time in self-directed learning in a specific field that is occupying his attention at that moment.

2.4.4 Adult learning theories in light of the widening participation in Higher-Education

The criticism that has been levelled at andragogy has been directed at the theory itself, as well as at its implementation in light of the widening participation in HE policy (see section 1.2). One of the criticisms raised with respect to andragogy was by Lee (2003), who claimed that Knowles had consolidated his theory in the period before the policy on widening participation and that in actual fact the population he faced belonged to a specific American segment of the 1970s, namely, white, male, educated and middle class. At present, the adult population studying in HE institutions is composed more of women, students from working class backgrounds and ethnic minorities, whose experience is not suited to the learning environment (Leathwood, 2001; 2006) and whose skills are not compatible with the principles of andragogy (Knowles, 1984).

Claims have in general been voiced that HE institutions must gear up to cope with the new population and to modify some of the conventions and requirements relating to curricula that are observed in them. Medway, et al. (2003) claim, that this means, among other things, lowering the academic requirements and lowering the level of teaching, where necessary. However, there are other claims that it is not a matter of lowering the level, but rather changing the model of learning, e.g. changing from deep learning mode to a surface learning one (Haggis, 2003).

According to Haggis (ibid), universities must adjust themselves to the new population of non-traditional students. She states that academia must free itself of the assumption that the students' aims are identical to those of the academic world, because the new populations that go to university do so out of instrumental motives and not out of an interest in satisfying intellectual curiosity alone. Haggis criticises the model of deep/surface learning (Entwistle, 1997) and claims that not all students are capable of deep learning. Haggis, like Lee (2003), also criticises the assumption that is commonly accepted in adult education theories, namely, that students come with previous experience and that it is possible to construct a curriculum, based on this experience (Knowles, Holton III and Swanson, 1998). In her claim, students who go to university today in the framework of widening participation do not have previous experience that is relevant to their university studies. As found by Pargetter, et al. (1998), most of them prefer surface study and do not always understand what is required of them in the framework of academic studies. In addition, the new students also lack confidence in all matters relating to their learning capabilities. Haggis (2003) claims that the preconceptions of the academic world and the values it tries to impose on the new students are elitist in nature and there is an exaggerated importance, in her view, that is given to deep learning. She claims that in the wake of the new policy of mass education, the HE system must recognise the fact that this kind of learning is not suited to everyone and that surface learning according to the level, language, motivation and previous experience of the students must be allowed and accepted (Haggis, 2006).

The position assumed by Haggis (2003) is in contrast to that of Barnett (1997), who claims that universities must maintain their traditional role and educate for values of criticality while continuing to educate students with the aim of their ultimately adopting a critical thinking, rather than striking a compromise and adjusting to the population of new students who perceive HE from an instrumental viewpoint. Barnett (2000a; b) claims that universities today have to contend with an environment that is supercomplex and that supercomplexity is intrinsic to the modern definition of the university. This is because universities must provide an answer to the requirements of different forces that at times contradict each other – those of the students, the academic staff and employers, who expect university graduates of a high standard.

With regard to academic requirements, Barnett and Coate (2005), who emphasise the importance of an established curriculum in HE institutions, do not object to the expansion of the curriculum in order to adjust it to the requirements of the new 21st century reality. On the contrary, they claim that the curriculum must be adapted to widened participation. However, they insist that three basic fields must still be maintained and that the students' abilities in these three fields, in accordance with the various disciplines, must be developed: 'knowing', i.e. discipline-specific competences understanding and critical reasoning, 'being', i.e. self-understanding, self confidence, self reliance and critical self-reflection in the subject area and 'acting', i.e. skills like oral presentations in the subject area or any other acting out of practices of a discipline (p. 70). In this regard, Yorke (2004) also agrees that the curriculum must be adapted to widened participation (Knight and Yorke, 2003; Yorke and Knight, 2007) and employability should be embedded into it.

However, addressing the issue of deep/surface learning model, Yorke (2006) does not accept Haggis' (2003) suggestion that the new students are not capable of deep learning and proposes three approaches to study: deep, surface and strategic. Yorke (2006) agrees with her, that the new students are motivated by the instrumental approach to study but according to him, in the strategic approach students use the deep or surface approach according to which one appears to them to be suitable. Thus, for example, they will use the deep approach with respect to the part of the curriculum that they consider to be important for future employment and will use the surface approach for the part they regard as less critical in terms of their professional future.

Not giving up on deep learning, Marshal and Case (2005), although admitting that deep learning does not suit all students, claim that the core values of HE do not need to be redefined and that there is no need to sacrifice the requirements of deep learning in order for them to be suited to mass education. Instead of this, they state, deep learning should be encouraged among students who have the willingness and aptitude for it. As for the rest, academic skills like those proposed by Haggis (2003), should be advanced with the aim of eventually leading them to deep learning.

Haggis (2006) also refers to the learner-centred approach and to the reliance on the previous experience of the learners, which is part of the principles advocated by andragogy (Knowles, 1984). According to Haggis (2006), today, the variety in the students who turn to HE is too great and previous experience cannot be assumed as a basis on which to build. She proposed a pedagogic approach based on 'collective inquiry’ (p.10), in which the teacher is able to observe how the students are thinking, talking and approaching a subject matter and students are able to observe how other students and how the teacher is doing that, this might afford a new type of understanding rather than traditional lectures based on transmission of knowledge.

In summary, no established theory was found that could explain how adults learn and in particular, no theory was found that provides an answer to all the learning environments in which adults study (Frey and Alman, 2003). What emerges from the literature survey is that in most of the cases a mix between the principles of pedagogic education and andragogic education would be appropriate (Donaldson, Flannery and Ross-Gordon, 1993; Birzer, 2004). In relating to the characteristics of the adult learner as mentioned earlier (section 2.4.1), it should be noted that most of the students in the academic college in which the research was carried out possess the learning characteristics of children. This is because for most of them, this is their first learning experience since leaving high school and they are therefore, according to hooks (1994), Cranton (2000) and Haggis (2003), more comfortable with the educational approach that they were used to, i.e. pedagogy. On the other hand, they have adult traits from the point of view of their social and family commitments. This results in their need to absent themselves from lessons and then catch up with the material studied in class through independent learning using MM study material uploaded to the course website. The subject matter in the ***Computer Literacy*** course, being new to the students, dictates the use of teacher-oriented pedagogic learning. This teaching approach enhances the importance of the teacher in learning and therefore, raises the question of whether an unfamiliar voice will be a disturbing factor for this type of population when learning is blended and there is a close familiarity with the course teacher.

2.5 Digital literacy and Computer Literacy courses

This section presents an overview of digital literacy and a description of ***Computer Literacy*** courses and their status throughout the world in general, in Israel and the college in which the research was conducted in particular. The specific course referred to and the questions that arose during its delivery constituted the trigger behind the research question and hypotheses.

2.5.1 Digital literacy

Digital literacy is a concept whose definition is still a matter of controversy owing to its complexity. What was referred to in the 1980s as computer literacy (Hunter, 1984) – a very general definition that focused principally on skills in the use of software, but which in fact, encompassed everything that involved working with a computer, including programming (Goodson and Mangan, 1996) – has undergone changes while attempts have been made to arrive at a definition that would be commensurate with the times. The term digital literacy entered the scene in the late 1990s with publication of the book 'Digital Literacy' by Gilster (1997), gaining momentum in the early 21st century (Bawden, 2008). In 2002 the term Information and Communication Technology (ICT) literacy was coined, which included the concept of communication tools and skills that would allow a person to be part of a knowledge society (ETS 2002). Attempts have continued to be made to define the exact nature of digital literacy (Livingstone, van Couvering and Thumim, 2005), while features such as Web 2.0 have been added as technology advanced and technological applications widened, with changing skills being included in the definition (Jenkins, 2006; Coiro, et al., 2008).

The term, however, is still unclear and arguments still rage over the exact definition of the skill. Today, digital literacy, or its synonym '21st century skills', also includes types of thinking: critical thinking, problem solving, creative thinking, decision making and learning. In addition, it includes collaborative work modes and work tools requiring informational and technological literacy – not just their massive use but also creation of content (Gee, 2010; Davis, Fidler and Gorbis, 2011; Hobbs, 2011).

Hobbs (ibid) describes digital citizens according to the way in which they connect to digital tools. The definition covers a wide range of skills that are required of the students:

- Use of applications, including skills in mouse control, file management, navigation in a hypertext environment, familiarity with software, familiarity with social media, cloud computing and Internet searches;

- Creative and collaborative skills, including group work, brainstorming, digital curation and network interaction;
- Evaluation of information, including skills in evaluation of information on the Web, understanding of one's own perspective, understanding of the balance of forces that are behind the dissemination of information on the Web;
- Skills relating to Web ethics, including evaluation of risks, social responsibility, ability to distinguish between the concepts of private and public and compliance with copyrights;

The latest attempt at defining the term 'digital literacy' was made in January 2013 by The American Library Association (ALA). Embedded in the definition are multiple dimensions, emphasising both technical and cognitive skills: 'digital literacy is the ability to use information and communication technologies (ICT) to find, understand, evaluate, create and communicate digital information. Basic reading and writing skills are foundational; and true digital literacy requires both cognitive and technical skills' (ALA, 2013 p. 1). In recent years, the term 'transliteracy' is being used (Thomas, et. al., 2007), which incorporates the interaction of a variety of skills across a range of media and tools and is still debated and in a state of formation (Liquete, 2012). Recently, the Mozilla Foundation is trying to define 'web literacy', concerning the skills necessary for the 21st century for web users. They define four basic literacies:

1. *Exploring* - navigating the Web while learning, questioning and evaluating what it has to offer;
2. *Creating* - creating things with the Web and solving problems while respecting the work of others;
3. *Connecting* - communicating and participating appropriately in one or more Web communities;
4. *Protecting* - protecting the Web as a public resource for free expression; (Mozilla, 2013).

Although, today, students are regarded as being digital natives, it turns out that they do not know how to use the Internet intelligently and the computer skills they have are superficial (Beetham, 2009). According to reports from the LLiDA project (Learning Literacies in a Digital Age), it was found that digital literacy among students of HE is deficient (Beetham, McGill and Littlejohn, 2009). Although there are large variations among the student population, by and large they think they know more than they do (Greaves, Bradley and Holley, 2012).

Digital literacy is important in a number of fields. It is of relevance in the worlds of education, work, technological business, governments and the HE system, all of which have an interest in people being digitally literate and capable of using a computer intelligently (Beetham, 2010; Holley and Oliver, 2011).

2.5.2 Computer Literacy courses

Due to the importance of digital literacy, there is an expectation from the educational system to provide workers, who are computer literate. Hence, the importance of ***Computer Literacy*** courses in HE (Mahapatra and Lai, 2005; Mason, 2006; Barrera, 2012; ECDL, 2013; Flsenate, 2013).

Research has shown, that a large number of users of computer programs, including popular ones, such as MS Word™, MS PowerPoint™ and MS Excel™, lack the knowledge required for effective operation of the programs. Thus, they perform actions that are contrary to the inherent program logic, e.g. the space bar is used to centre a line of text, the ENTER key is activated at the end of each line or struck repeatedly to start a new page (Fu and Gray, 2004). They thus, do not enable all the functions allowed by the program. Many have come to knowledge of the program in a informal way, out of an immediate need and through trial and error, without an in-depth understanding of the logic and principles on which the program is based (Hoffman and Vance, 2005). Owing to erroneous use of the program, many of its functions are not implementable while many operations are performed ineffectively. In fact, in recent years a criticism has been raised in regards the suitability of software meant for business use, like MS Office™, to educational and academic use (Scardamalia and Bereiter, 2008). For one example, studies showed that word processors, like MS Word™, on one hand have the potential of aiding in typing text, but on the other, force the students to indulge in tiny low-level details relating to the single sentence or a word, interfering with high order thinking (Haas, 1989). Another issue is the use of PowerPoint presentations, which according to Turkle (2003) and Tufte (2006) have an inhibiting effect on cognitive processes due to its inherent linear short sentence structure, which does not allow presentation of more than one slide at a time, an essential feature for presenting mathematical arguments, for instance (Giveon, 2008). Nevertheless, this kind of software is commonly used in education and this is what students encounter when they enter the job market, thus, this is what ***Computer Literacy*** courses are expected to address.

There is, therefore, an ongoing need for computer application courses in HE institutions, in order to enable students to acquire skills that will help them in the academic work they are required to perform during the course of their studies. Subsequently, they will need these skills in their professional lives, with topics including proper use of word processors, preparation of presentations and use of electronic spreadsheets (Dednam, 2009). The most popular software package is MS Office™ and the programs that are taught in many computer applications courses are MS Word, MS PowerPoint and MS Excel™, net surfing, sending and receiving emails and understanding of the operating system (Radi, 2002; Bartholomew, 2004; Burger and Blignaut, 2004; Hoffman and vance, 2005).

Many universities and colleges worldwide and in Israel as well, offer ***Computer Literacy*** courses. These courses are either mandatory or voluntary and are usually offered to the first year students allowing the acquisition of skills necessary for them during the course of their studies and ultimately, in the framework of their job responsibilities. The courses are generally one-semester courses involving two academic hours a week and are based either on conventional methods or distance learning (Bartholomew, 2004; Burger and Blignaut, 2004; Corbel and Gruba, 2004; Hoffman and Vance, 2005; Johnson, Bartholomew and Miller, 2006; Banerjee and Kawash, 2009; Dednam, 2009; Epperson, 2010).

In the college in which the current research was carried out, students who demonstrate mastery in computer skills either by undergoing an exemption test or by exhibiting a relevant academic document are exempted from the course. However, for all the other students the ***Computer Literacy*** course is compulsory and of the conventional type, i.e. face-to-face, focusing on the imparting of work skills with a word processing program, presentations and electronic spreadsheets using MS Office™, alongside the acquisition of scholar web search skills.

The current research was conducted among first-year students who were taking a ***Computer Literacy*** course during the first semester of 2010 academic year. The course was conducted in a computer laboratory according to a traditional setup, i.e. frontally, and was accompanied by a website intended for reference and learning management.

2.5.3 Teaching in the Computer Literacy course- a pedagogical approach

In the ***Computer Literacy*** course, which the research addresses, the lecturer is the provider, i.e. the course is teacher-centred. One of the assumptions of andragogy states that the adult learners are experienced and that learning should be based on their experience (Knowles, Holton III and Swanson, 1998). However, in learning computer skills, the students are considered novices and thus, cannot be treated as having previous experience that is relevant to the field of study. Students starting out on their professional career, cannot rely on previous experience, are not problem-focused, are not mature and are not geared to self-directed learning (see section 2.4.4). In all matters related to a new field of knowledge for the students, the principles of andragogy do not hold water, which is why the teaching method in the ***Computer Literacy*** course draws on the pedagogic approach. This decision to draw on the pedagogic model with adult learners can be supported by Birzer (2003; 2004). Birzer criticised the behaviouristic approach applied with police officer training and suggested the andragogic approach which highlights self-directed learning and drawing on the experience of the trainees as a more appropriate one. However, Birzer recognised that in cases where the trainees have to learn and conceptualise new material or when they have to learn new mechanistic skills, the pedagogic teacher-centred approach was more appropriate.

In the context of the present research then, since the field of the subject matter and the students' traits dictated pedagogical instruction, teaching is teacher-oriented, the lecturer is the provider and the students regard the teacher as important. Thus, in relation to this study, it was assumed that importance will be attached to narration in the voice of the familiar teacher from the class in MM auxiliary materials and that narration in an unfamiliar voice will exert some influence.

The lessons in the ***Computer Literacy*** course were such that during part of the lesson the students' screens were locked, demonstrating the teacher's screen, with the students receiving explanations and demonstrations of the subject being studied. Subsequently the screens were released to allow the students to practise what they had learned.

When studying computer skills in class, the students received detailed explanations on ways to perform a variety of computer operations. By placing an emphasis on the logic on which the program and its operations are based, the knowledge they acquired was application specific strategic knowledge (Bhavnani and John, 2000) and not merely a rundown of the technical procedure for performing the operations. That means, understanding the entities the program relates to and defining them correctly, e.g. use of the ENTER key in MS Word™ for creating a new paragraph and not for moving to a new line – if this is not understood, many actions are disrupted, since they are contrary to the logic of the program.

The auxiliary materials uploaded to the course website included NVSCs comprising short units of two to five minutes each, which were intended to aid in revision of the subjects that were learned in the lesson. The captures included narration and operations performed by the course teacher and viewed on the screen. No captions were added and the teacher's image did not appear on the screen.

The following figure (Figure 2-1) visualises the context of the research and the learning environmental factors that might influence the learning of the adult students, which comprise the research population.

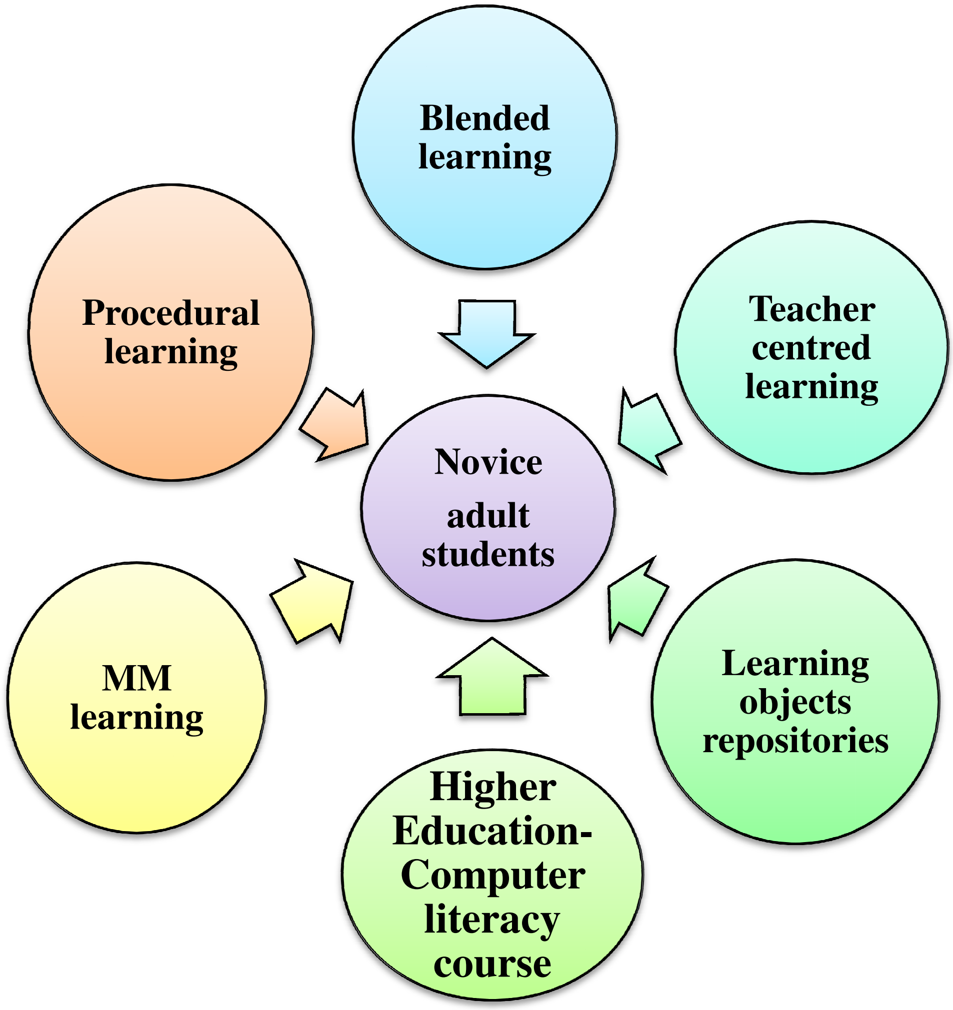

Figure 2-1: The context of the research

Figure 2-1 shows that the adult student is in the centre of the learning environment, namely, Computer Literacy course in HE, where procedural learning is taking place via a teacher centred learning in a blended learning environment. Auxiliary learning materials are MM LOs supplied by the course instructor and can also be found on the web by free access to repositories.

Chapter 2 reviewed the context of the research. It was clarified that from the viewpoint of the traits of the students who participated in the research and the context of the research, although the students were adult the model that was most suited to them in the classroom was, in fact, the pedagogic one with learning being teacher-oriented. This way of teaching could intensify the impact that might be to viewing of MM study material having narration with the voice of a teacher who is not known to the students.

The next chapter will elaborate on the conceptual framework underpinning the research hypotheses. The chapter will examine cognitive load related theories and their application in MM instructional design. Theories related to individual differences underpinning the hypotheses of the research will also be reviewed.

Chapter 3 - Theoretical perspectives: the underpinning of the research hypotheses

In the previous chapter the context of the current research was established, i.e. NVSCs used in a blended teacher-centred ***Computer Literacy*** course for adult students. The present chapter will review four cognitive load related theories, namely, ***Cognitive Load Theory*** (Sweller, Ayres and Kalyuga, 2011)***, Cognitive Theory of Multimedia Learning*** (Mayer, 2005a), ***Cognitive-Affective Theory of Learning with Media*** (Moreno, 2005) and ***Social Agency Theory*** (Moreno, et al., 2001; Mayer, Sobko and Mautone, 2003; Mayer, 2005b). Further the relationship between the ***Computer Literacy*** course and the research hypotheses stemming from them will be reviewed. In section 3.9, individual differences will be discussed and additional hypotheses will be introduced.

Studies conducted on podcasts (narration only) have found that students prefer the voice of a lecturer with whom they are familiar to that of an unfamiliar lecturer (Prion and Mitchell, 2007) and that hearing the familiar teacher on a podcast improved student-learner relationship (Salmon and Nie, 2008). However, these studies focused on audio podcasts only and on students' preferences alone. In comparison to NVSCs, it is possible that in audio podcasts, where voice is the only tangible attribute in the eyes of the student, it assumes more significant proportions than in NVSCs that integrate voice and screencasts, where voice serves as an accompaniment to the demonstrations viewed on the screen, thus, perhaps, lessening its impact. Moreover, it is important not only to study students' preferences for a particular learning material but also its actual influence on their learning. An additional research study found, that students perceive class instructor narrated presentations *versus* presentations without narration, as more favourable in an online situation, although quantitative data revealed no significant difference between the two types of learning material (Mandernach, 2009).

The current research related to the affective domain of learning from a cognitive load perspective. Students studying in a face-to-face, teacher-centred course create a personal relationship with a lecturer whom they see on a regular basis (Rogers, 1983). Thus, it is important to see if there is any significance in the presentation of MM materials to students narrated by their regular course teacher *versus* a teacher with whom they are unfamiliar and what impact it has on their learning, provided that all aspects of the MM learning material are kept constant besides the identity of the narrator.

3.1 Cognitive Load Theory

Cognitive Load Theory (CLT) assumes two categories of knowledge: biologically primary knowledge and biologically secondary knowledge (Sweller, Ayres and Kalyuga, 2011). Primary knowledge is knowledge we acquire over many generations and refers to the evolution of humanity (Geary, 2007; 2012). Biologically primary knowledge is essential for the survival of the human species. Therefore, we have evolved to acquire primary knowledge in a rapid, effortless and mostly automatic way without consciously processing it. For example, we are predisposed to acquire native language skills and automatically and unconsciously engage in common social interactions (Kalyuga, 2011c), while the secondary knowledge is cultural and has to be taught through direct explicit instruction which is expected to facilitate the acquisition of that knowledge. As an instructional theory, CLT applies to the secondary knowledge. However, the theory also argues that people can adapt biologically primary knowledge to assist in processing and acquisition of secondary knowledge (Sweller, 2006; Plass, Moreno and Brünken, 2010; Paas and Sweller, 2012).

Many cognitive load based studies have provided valuable insight into the specific conditions under which some learning environments are more effective for learning than others; a few examples: (Paas, 1992; Paas and Van Merriënboer, 1994b; van Merriënboer, Kester and Paas, 2006; Paas, Van Gerven and Wouters, 2007; Wouters, Paas and van Merriënboer, 2009; Liu, et al., 2012). However, the diversity of learners and the variety of learning environments and conditions call for more research that will add to the understanding of learning. This section presents a review and a discussion of the principles of CLT and its connection with the present research and other theories on which the research was based.

3.1.1 Cognitive architecture

The research aimed to reveal the impact of the familiarity with the narrator in MM learning. To examine the process of learning and its effectiveness we need to understand the factors that cause ineffective cognitive load and what factors can help reduce this load and make learning more efficient. Therefore, in this section we look at the human cognitive structure and the mechanism that affects the cognitive load and thus, also, the effectiveness of learning.

CLT emphasises human cognitive architecture and claims that learning occurs in two layers of memory: **Working Memory** (WM) and **Long-term Memory** (LTM). According to the theory, human cognitive architecture is critical to instructional design (Sweller, 1988; Cooper, 1990; Sweller, Van Merriënboer and Paas, 1998; Sweller, Ayres and Kalyuga, 2011) and the goal in designing learning materials is to make them cause reduced load on WM.

3.1.1.1 Working memory

Working Memory is the part of memory that is responsible for the processing of information (Miller, 1994; Cowan 2001) and its capacity is significant for cognitive functioning (Yuan, et al., 2006). People are aware only of information that is present at a given moment in their WM and are not aware of the vast amount of information that is stored in the LTM. Thus, WM has also been equated with consciousness (Sweller, van Merriënboer and Paas, 1998). When a person has to contend with new information, the WM is very limited in terms of both capacity and duration, being able to save about seven (plus or minus two) items of information at the same time (Miller, 1994) and process four (plus or minus one) according to Cowan (2001). WM is sometimes confused with short-term memory. Engle (2002) states, that WM refers only to the attention related aspects of short-term memory, while according to Cowan (2008), WM includes short-term memory and other processing mechanisms that facilitate the usage of short-term memory. Both definitions point to a system used for processing and storage. CLT refers to WM because measures of it have been found to correlate with intellectual aptitudes (Engle, et al. 1999).

3.1.1.2 Long-term memory

Long-term memory (LTM) can last from as little as a few days to the end of life. From a structural standpoint and functionality, it differs from WM, which may store information for only a few seconds (Baddeley, 1992; 2000).

The capacity of LTM is in fact unlimited. The information stored in LTM is organised in the form of knowledge structures called cognitive schemas (van Merriënboer and Ayres, 2005) and a person's expertise derives from the information stored in the schemas. The cognitive schemas serve not only in the organisation and storage of information, but also in increasing the capacity of the WM. Despite the fact that the WM can contain only a limited number of items at the same time, the size of the items is not limited (Sweller, van Merriënboer and Paas, 1998) and therefore complex schemas that contain a large number of interconnected elements can be found in the WM in the form of a single unit (Paas and Sweller, 2012). As a result, students who have to contend with material that they have learned in the past and that is stored in the LTM are free of the processing limitations of the WM.

Furthermore, automation is an additional component of the cognitive schemas structure. Automation occurs when information that is stored in the schema can be processed automatically and without any conscious effort, thus, freeing the resources of the WM (van Merriënboer and Sweller, 2005). The principal aims of instructional systems that are designed from a cognitive load perspective are to increase the efficiency of the construction and automation of schemas in the LTM (Sweller, van Merriënboer and Paas, 1998).

Since this study examined the efficiency of MM learning with different narrators in terms of students' familiarity with them, the goal is to find out which learning material is more effective to learning that is, enabling schema activation and construction and thus, allowing better test performance due to reduced extraneous load on WM.

3.1.2 Cognitive load

After cognitive structure has been reviewed, the following paragraphs will explain the processes that may cause cognitive overload. CLT sees the construction and subsequent automation of schemas as the main goal of learning (Sweller, van Merriënboer and Paas, 1998; Sweller, Ayres and Kalyuga., 2011). It was found that learning materials that are mal-designed create cognitive overload and damage the effectiveness of learning. A discussion of cognitive load is needed, since the purpose of the present study was to check whether an unfamiliar narrator renders the MM learning material mal-designed, thus, causing a cognitive overload.

Cognitive load can be defined as a multidimensional structure that represents the load created in the WM of the learner during the performance of a certain task. The causal dimension of the cognitive load represents the interaction between the task and the learner's characteristics, e.g. age, level of expertise in the studied subject and spatial ability. Spatial ability is the capacity to understand and remember the spatial relations among the objects presented. In studies conducted in regard to cognitive load exerted by MM learning material Mayer and Sims (1994) explained spatial ability as the ability to rotate or fold objects in two or three dimensions and to imagine the changing configurations. The assessment dimension represents the measurable characteristics of three aspects of cognitive load: mental load, mental effort and performance (Paas, Van Merriënboer and Adam, 1994; Kürschner, 2002; Paas, et al., 2003).

Mental load is the load that is created by the demands of the task at hand and the demands of the environment in which the task is being performed, such as the complexity of the task, use of MM and time pressure. This load is the result of interaction between the task and the learner's characteristics. Mental effort relates to the degree of effort invested by the learner in performing the particular task. According to Paas and van Merriënboer (1993), this aspect, in fact, represents the cognitive load of the learner. Mental effort is measured at the time the learner is engaged in performing the task of the study and the intensity of the effort invested by the learners in performing a particular task can be considered as a true estimate of their cognitive load (Paas and Van Merriënboer, 1993; Paas, van Merriënboer and Adam, 1994). Performance is assessment of how the learner fares in recall and transfer tests.

In the last decade, since Sweller, van Merriënboer and Paas (1998) introduced the germane cognitive load into CLT all studies related to CLT referred to three types of cognitive load, which were considered additive: intrinsic cognitive load, extraneous cognitive load and germane cognitive load. Intrinsic cognitive load was considered as dependent upon the element interactivity in the learning condition, that is, the amount of interacting elements the learner has to deal with during learning and this load was thought to be fixed and inherent to the subject to be learned. On the other hand, extraneous cognitive load was related to the instructional design and germane cognitive load was related to the acquisition of knowledge by creating new cognitive schemas in the LTM (Sweller, van Merriënboer and Paas, 1998; Sweller, Ayres and Kalyuga, 2011). In recent years a lot of criticism was raised regarding the ambiguity of the theory especially due to circular interpretations it allowed when explaining cognitive load aspects of different learning conditions (Schnotz and Kürschner, 2007; de Jong, 2010; Moreno, 2010; Moreno and Mayer, 2010). In response to that criticism, Sweller, the establisher of CLT, suggested some reconsiderations and re-conceptualisation of the theory (Sweller, 2010; Sweller, Ayres and Kalyuga, 2011). Currently, CLT distinguishes between only two additive types of cognitive load both of which imposed by the instructional material's element interactivity: intrinsic cognitive load and extraneous cognitive load. Equivalently, the theory distinguishes between two types of WM resources: extraneous resources, which deal with intrinsic load, caused by the learning material's unnecessary element interactivity and which hinder learning and germane resources, which deal with intrinsic cognitive load, caused by essential element interactivity of the learning material in order to enhance schemas creation in the LTM. This implies that element interactivity underlies not only intrinsic load, but also both germane and extraneous processes (Sweller, 2010; Kalyuga, 2011a; 2011c). In the new formulation, germane cognitive load has been removed from the additive equation because it is regarded as belonging to a different category (Ng, Kalyuga and Sweller, 2013).

3.1.2.1 Intrinsic load

Intrinsic load is defined by the interaction between the nature of the learned subject and the extent of knowledge that the learner possesses in the subject. Novel, high element interactivity information is likely to impose high intrinsic cognitive load. This load cannot be influenced by the design of the instructional materials and cannot be changed without altering the learning objectives of that particular task (Sweller, van Merriënboer and Paas, 1998; Paas, Renkl and Sweller, 2003; Ayres, 2006a; Hasler, Kersten and Sweller, 2007; Wouters, Paas and van Merriënboer, 2009). Element interactivity level can be determined by estimating the number of interacting elements in a given learning condition (Sweller, 2010); the more elements there are within a learning task and the more interaction there is between them, the higher the experienced intrinsic cognitive load will be (Sweller and Chandler, 1994; Chandler and Sweller, 1996).

In recent years there have been some researchers who claimed that intrinsic load can be alleviated by introducing the material to the students in a simple-to-complex order so that they do not experience its full complexity (van Merriënboer, Kürschner and Kester, 2003; Gerjets, Scheiter and Catrambone, 2004; Ayres, 2006a). Van Merriënboer, Kester and Paas (2006) suggested a very similar approach, the whole-part approach, in which the material is presented in its full complexity from the start, but the concentration is on the simpler elements.

In relation to this study, intrinsic load was considered as pre-determined by the subject matter, i.e. the specific computer skill being taught. The students experienced the various voice types with the same NVSCs. No changes were made to the way material was presented to the students, because the focus of this study was to reveal the influence of the familiarity with the narrator in the NVSCs. Thus, keeping everything else constant, it left only to find out whether different narrators could affect students' learning.

3.1.2.2 Extraneous load

Extraneous load is the additional load beyond the intrinsic load, caused by extraneous processing and it is the result of deficient design of the instructional method and materials or poor learner strategies (Sweller, 1988; Sweller, van Merriënboer and Paas, 1998; Mayer, 2011a). When large amounts of the learner's WM capacity are used for extraneous processing, there may not be sufficient remaining resources for engaging in essential (intrinsic) and generative processing. It follows that an important instructional goal is to reduce extraneous processing. Thus, extraneous load may be avoided by locating the sources for extraneous load and changing the instructional design accordingly (Sweller and Chandler, 1991; Chandler and Sweller, 1992; Cerpa, Chandler and Sweller, 1996; Lowe, 1999; Ayres and Sweller, 2005; Mayer, 2011a).

As stated before, element interactivity is associated with both extraneous and intrinsic cognitive load. When an instructional condition imposes on the learner a large number of interacting elements, many of which are not relevant to learning, then we can say that this learning condition imposes high extraneous load. This kind of load is due to the manner in which the information is presented to the learner. If element interactivity can be reduced without altering what is learned, the load is extraneous; if element interactivity can only be altered by altering what is learned, the load is intrinsic (Beckmann, 2010). If intrinsic cognitive load is low, a high extraneous cognitive load may not inhibit learning, because the total cognitive load may be less than available WM resources. However, under high intrinsic cognitive load conditions, instructional design, which may affect extraneous cognitive load, may be important.

In relation to the present study, the recall and transfer tasks the students had to perform, involved high element interactivity, with element interactivity in the transfer tasks being higher than that in the recall ones (Appendices F, G and H). The only characteristic that was changed in the various NVSCs presented to the students was the narrator, which allowed the comparison of the effects of the familiarity with the narrator on students' learning. It was hypothesised here that experiencing an unfamiliar narrator’s voice might impose an extraneous cognitive load on the learners because they would find it more difficult to establish a positive sense of social interaction necessary for learning, due to fewer social cues compared to an interaction with a familiar teacher (see section 3.4).

3.1.2.3 Germane load

Germane cognitive load was introduced into CLT ten years after it was suggested by Sweller (1998) for the first time. Germane load is different from the two other types of cognitive loads and according to the current formulation of CLT (Sweller, Ayres and Kalyuga, 2011), belongs to a different category. While extraneous and intrinsic cognitive load are additive and, provided that the learner expertise is constant, dependent on the element interactivity of the learning material, the germane load depends on the learner’s characteristics only. Germane cognitive load is related to the amount of WM resources the learner allocates to handle element interactivity. If we assume a given amount of motivation, the learner has no control over the germane load. However, higher motivation may lead the students to allocate more WM resources to generative processes. If the learning condition facilitates a decrease in extraneous load and thus, allows the learner to handle mainly the element interactivity, the germane load might be maximised and so will the learning. If the learners have to handle the extraneous load as well, their learning will be inhibited because the more WM resources are devoted to handling extraneous cognitive load, the less will be available to deal with intrinsic cognitive load and so the less will be devoted to germane processes. In an optimal situation regarding germane processing, more WM resources are allocated to handle the element interactivity related to intrinsic load and fewer resources are directed to handling element interactivity related to the extraneous load (Sweller, 2011). In relation to the present study, the research hypothesis is that with an unfamiliar voice the learners may find it more difficult to establish a positive interaction while interacting with the NVSC and this may exert extraneous cognitive load on their WM and thus, it might be assumed that the learners will have less WM resources to allocate to germane processes.

In summation, learning is highly dependent on the learner's cognitive load, which can help or hinder learning. The aim in designing learning materials is to reduce the extraneous load and increase the germane load in order to facilitate learning.

The primary goal of CLT is to help devise instructional materials that reduce extraneous cognitive load and so decrease the WM resources devoted to extraneous processes and so make more resources available for germane processes by handling intrinsic cognitive load (Kalyuga, 2011a; Sweller, Ayres and Kalyuga, 2011). In accordance with CLT, extraneous load should always be reduced while intrinsic cognitive load should be optimised, i.e. adapted to the learner previous knowledge. Intrinsic load should be neither too low nor too high in order to activate the necessary germane processes.

According to CLT formulation, the more WM resources that must be devoted to extraneous cognitive load, the fewer will be available to deal with intrinsic cognitive load, reducing learning. This formulation assumes that the learners are fully engaged and all their available WM resources are being devoted to dealing with intrinsic and extraneous cognitive load (Sweller, 2010; Kalyuga, 2011a).

3.1.3 Cognitive load measurement

CLT explains learning effectiveness, but in order to be able to rate learning effectiveness we need a set of measurements. In relation to this study, measuring students' cognitive load while experiencing the different MM learning material and while performing a task together with task performance scores, enabled the researcher to figure out the efficiency of each form of learning material (with familiar class instructor's narration, unfamiliar male narration, unfamiliar female narration).

Cognitive load can be measured by estimating the mental effort (Paas, 1992; Paas, van Merriënboer and Adam, 1994; Paas, et al., 2003). The methods for measuring cognitive load can be divided into analytical methods and empirical methods (Xie and Salvendy, 2000). Analytical methods, such as mathematical models and task analysis, are oriented to measuring the mental load. Empirical methods, which are oriented to measuring the mental effort, gather subjective data by the use of rating scales, performance data, physiological data and psycho-physiological data and by means of visual signs of learning processes with the learners, such as clicks of the mouse and movement between screens.

Other methods for estimating cognitive load include dual task measures. In this technique, learners are evaluated while performing the primary task that they are supposed to carry out and in performing a secondary task that they are asked to carry out while performing the primary task. Generally, the secondary task includes an examination of the time of response to a visual or vocal signal (Sweller, 1988; Chandler and Sweller, 1996; Brünken, et al., 2002; Brünken, Plass and Leutner, 2003; van Gerven, Paas and van Merriënboer, 2006; van Gog, et al., 2009).

The problem in the dual task technique is that the secondary task disturbs the learners in performing the primary task and contributes to an increase in their cognitive load (Brünken, et al., 2002).

The methods for measuring cognitive load can also be divided into measurement of change (changes in the body or the mental state of the learner) and measurement of learning processes, by means of manipulations that can be observed on the learner during performance of the task, together with the results of the learning – such as examination of the response time in performance of a secondary task during performance of the primary task (Lowe and Boucheix, 2007).

Techniques of self-report by the learner also exist, the two most common being concurrent and retrospective reporting (Ericsson and Simon, 1993; van Someren, Bernard and Sandberg, 1994). In the concurrent reporting technique, the learners are required to verbalise all the thoughts that pass through their head while performing the task. In retrospective reporting, the learners are asked to report on their thoughts immediately after performing the task, which must therefore be very short since in long tasks there is a danger of some of the thoughts being forgotten. Concurrent reporting provides information from the WM whereas retrospective reporting draws information from the LTM. Concurrent reporting imposes a considerable load on the learner, especially in long tasks and in a MM environment that contains the same modality that is demanded in the reporting, e.g. text. These research methods require more in-depth study in order to investigate the implications of the technique itself on the learner's cognitive load (van Gog, Paas and van Merriënboer, 2005; van Gog, et al., 2009).

Stimulated recall interview is an additional tool that is intended to obtain a qualitative look into the processes that occur in the WM (Beers, et al., 2008). In this technique, students are asked to make retrospective reports of their thinking based on the provision of extensive retrieval cues of the preceding activity (Shavelson, Webb and Burstein, 1986; van Gog, et al., 2009).

Other types of measurement are those that are related to the physiological and psycho physiological realm. Measurements related to the physiological domain include heartbeat rate, brain activity (EEG), eye activity and Functional Magnetic Resonance Imaging – (FMRI). Measurements related to the psycho physiological domain, such as task-evoked pupillary response and eye tracking, are more valid, being sensitive to differences in cognitive load levels and are less intrusive (Paas, van Merriënboer and Adam, 1994).

An additional technique, that is an offshoot of learner reporting, is self-rating measuring, based on rating scales. This technique assumes that learners can assess themselves and report on the level of mental effort that they have invested in performing a particular task (Gopher, 1984; Paas, 1992). In this technique, questionnaires are generally used that contain measuring scales. It was found that these scales are relatively sensitive to small changes in cognitive load and that they are valid and reliable. A conspicuous advantage is that they are not invasive (Paas, 1992; Gimino, 2002; Ayres, 2006b).

Although the research that deals with the measurement of cognitive load is still in its infancy, it has aroused much interest, since researchers are concerned about obtaining insights into the interaction between cognitive load and instructional design. Recently researchers have begun to show an interest in the possibilities of measuring the intrinsic load, extraneous load and germane load separately (Ayres, 2006b; Cierniak, Scheiter and Gerjets, 2009). However, the new dual formulation suggested recently, eliminates the need for separate measurements of cognitive loads, since germane load cannot be measured at all and the other two can be easily manipulated by the researcher (Sweller, 2010; Kalyuga, 2011a). According to Sweller (2010), germane cognitive load cannot be measured, since it is defined in terms of the WM resources required to deal with intrinsic cognitive load rather than as an independent cognitive load. Stemming from the new suggested formulation there is no need to measure separate cognitive loads because the researcher can manipulate the element interactivity in a given learning condition and thus, increase or decrease the intrinsic cognitive load keeping the extraneous load constant or else manipulate the element interactivity so to increase or decrease extraneous load keeping intrinsic load constant. Since the overall cognitive load comprise solely of these two cognitive loads, they can be calculated this way. According to Kalyuga (2011), germane cognitive load is redundant and the dual framework CLT is complete without it.

In the present research, since overall cognitive load was measured in the different learning conditions while keeping everything constant besides the narrator's voice, it was assumed that any difference in cognitive load between the groups was due to the difference in extraneous load exerted by the different narrators.

In this research, use was made of traditional methods of measurement, since they are a more minor source of disturbance to the learner during the learning process. Measurements based on various technologies, could disturb the learners from learning and thus, skew the results of the measurement. Also, in accordance with recent recommendations (Mayer, 2010; Mayer, 2011b), the present research, in essence, sought to perform all the tests in a situation of natural learning rather than as a laboratory experiment and therefore any intervention that was not directly connected to the learning process would constitute a disturbing element. It was found that learners can interpret the different load scales in the manner that the researchers had intended and the subjective rating scales are more sensitive to changes in the mental effort that is required to perform a particular task than any physiological measurement and mental effort is actually an index to cognitive load (Paas, van Merriënboer.and Adam, 1994). However, some criticism has been directed at the self-report mental effort measurement for not being able to distinguish between different types of mental effort. For example, Xie and Salvendy (2000) differentiated between five types of mental effort: ***instantaneous load***, which represents fluctuations of load each moment during task performance; ***overall load*** which is the experienced load based on the whole working procedure; ***peak load***, which represents the maximal effort expended at a particular time when performing a task; ***average load*** which refers to the mental effort over time; and ***accumulated load*** which refers to the total load for a particular task. These authors claim that with the self-report mental effort questionnaire one cannot be sure to which kind of mental effort the student refers. However, measuring the different mental effort requires invasive tools, which this research was trying to avoid.

In the present research, mental effort was measured with the help of a one-item self-report questionnaire (Paas, 1992; Paas, et al., 2003) that reflected the mental effort invested in learning with the NVSC (Appendix I). Following this, the mental effort was measured once again by means of the same questionnaire, examining the mental effort invested in performing a recall test and a transfer test (Appendix J).

However, it was found that mental effort alone is not enough to evaluate the cognitive challenges that the learner faces, since the intensified effort does not necessarily lead to better performance. On the other hand measuring performance alone may not give us a full picture in regard to the efficiency of the students' learning. It is possible that two learners will invest the same mental effort in the performance of a certain task and will nevertheless achieve different results. In other words, there will be a difference between them in learning efficiency (van Gog and Paas, 2008; Künsting, Wirth and Paas, 2011). Learning efficiency is also referred to as ‘instructional efficiency’, ‘mental efficiency’ (Paas, et al., 2003) and ‘cognitive efficiency’ (Hoffman, 2012). The term that was used in this study was ‘learning efficiency’ in general, and precise terms were allocated to the different indices, i.e. ‘learning process efficiency’, ‘task efficiency’, ‘three-dimensional learning efficiency’ and ‘motivation on task’, as will be explained in the following section.

3.1.4 Calculation of learning efficiency

In order to compare the efficiency of different instructional conditions two models were suggested: the ***likelihood model*** and the ***deviation model*** (Hoffman, 2012); the ***likelihood model*** refers to the ratio between performance and mental effort using the raw scores (Hoffman and Schraw, 2010), while the ***deviation model***, developed by Paas and van Merriënboer (1993) refers to the difference between the standardised Z scores of performance and mental effort. A standardised Z score indicates how many standard deviations an observation is above or below the mean. It is derived by subtracting the population mean from an individual raw score and then dividing the difference by the population standard deviation. It is used when calculation has to be conducted on scores, which are from different normal distributions, e.g. when mental effort score, which is on a 1-9 scale has to be subtracted from performance score, which is on a 1-100 scale (Witte and Witte, 2007).

The main criticism made by Hoffman (2012) in relation to the deviation model was that since it uses standardised Z scores it does not offer an external score of learning efficiency but rather a relative comparison to a referenced group. The author also claims that the efficiency measure can only be used to compare group efficiency and it does not allow comparing individual efficiency.

The aim of the present study was to compare the relative learning efficiency between the familiar voice group and the unfamiliar voice group. Thus, the deviation model suggested by Paas and van Merriënboer (1993), which demonstrates a wide scale use in the field of cognitive load related studies, was found to be the proper calculative model to be used.

Paas and van Merriënboer (1993) developed a calculative approach that combines measurement of mental effort on a task with task performance. According to this approach, a high grade in performance of a task that is accompanied by low mental effort is defined as high efficiency of task performance and a low grade in performance of a task that is accompanied by high mental effort is defined as low efficiency of task performance. The formula proposed by the researchers (Paas, Ayres and Pachman, 2008) is:

Equation 3-1: Task Efficiency

$$\mathbf{TE} = \frac{\boldsymbol{ZTaskPerformance - ZTaskMentalEffort}}{\sqrt{\mathbf{2}}}$$

Where:

TE - relative ***Task Efficiency*** of a learning situation

$\boldsymbol{ZTaskPerformance}$ –Standardised z-score of ***task performance*** measurement

$\boldsymbol{ZTaskMentalEffort}$ –Standardised z-score of ***mental effort on task*** measurement

Measurement of the mental effort during performance of the test, affords us a perspective of the learning process as well. Students who succeeded in acquiring more knowledge during the learning process itself due to the exposure to an instructional materials format that is more effective will show lower cognitive load during performance of the test than students who received learning materials that were less effective. In other words, if we examine only the level of test performance, with both the groups showing an identical level in this respect, we will conclude that the effectiveness of the learning materials was identical. However, if we also examine the mental effort that the students invested during performance of the test we will conclude that students who invested less mental effort in order to arrive at the same results are those who encountered more effective instructional materials and acquired greater expertise during a more efficient learning process. In other words, the learning materials to which they were exposed helped them to a greater degree in constructing the appropriate cognitive schemas. The following figure (Figure 3-1) visualises mental effort on task and task performance in relation to task efficiency as suggested by Paas and van Merriënboer (2003):

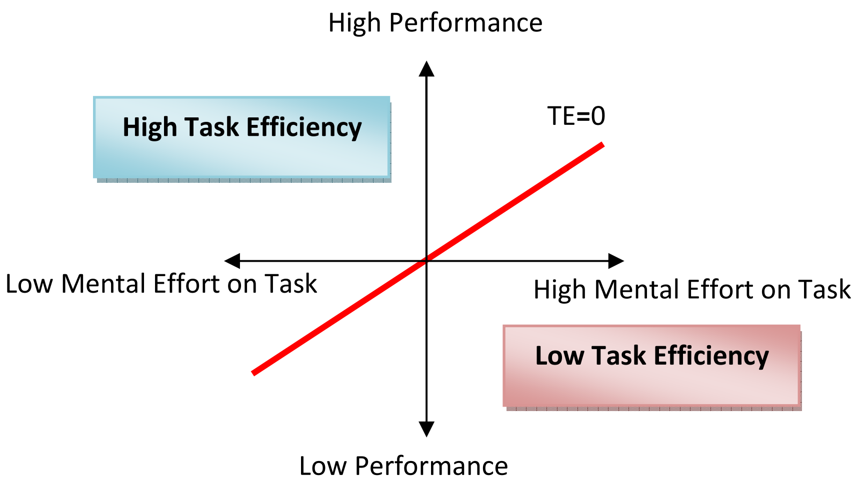

Figure 3-1: Mental effort – performance coordinate system for Task Efficiency (TE)

After proposing the ***Task Efficiency*** calculation (TE), a review of research studies that was carried out showed that most of the studies which used the efficiency calculations did not examine mental effort during test performance but rather mental effort during the learning process and test performance afterwards (van Gog and Paas, 2008). Thus, following this adaptation Paas, Ayres and Pachman (2008) proposed the index of ***Efficiency of the Learning Process*** (LPE). The rationale underlying this index is as follows: if, for example, two groups of learners with identical prior knowledge learn from instructional materials about an identical subject but in a different format and subsequently perform an identical test and if both groups report a high mental effort during the learning process but the first group showed a higher test performance, it may be inferred that the mental effort that this group invested during learning was more effective for learning than the mental effort invested by the other group whose test performance was low (Paas and van Merriënboer 1993; van Gog and Paas 2008).

The operative conclusions from this index are: assuming that the intrinsic load of the two study subjects is identical (the students study exactly the same subject, only in different formats) and that the students showed the same level of test performance in both the cases, the format in which the student invested less mental effort during the learning process is the more efficient one. The formula for calculating this index is:

Equation 3-2: Learning Process Efficiency

$$\mathbf{LPE} = \frac{\boldsymbol{ZTaskPerformance - ZLearningMentalEffort}}{\boldsymbol{\sqrt{2}}}$$

Where:

LPE - relative ***Learning Process Efficiency*** of a learning situation

$\boldsymbol{ZTaskPerformance}$ - Standardised z-score of ***task performance*** measurement

$\boldsymbol{ZLearningMentalEffort}$ - Standardised z-score of ***mental effort of learning*** measurement

From the research point of view, the mental effort that is invested during learning is different from that invested during performance of a test. The design of the instructional materials influences the mental effort of the learner during learning. During performance of the test, the test is identical for all the students and the mental effort is influenced mainly by the knowledge that was acquired during the learning process. These two indices of mental effort allow clearer interpretations and comparisons between different learning materials to be made where LPE is of the utmost importance, especially when our aim is to pinpoint the instructional design that causes less extraneous load.

During the research, the mental effort was measured three times: once during the learning process, a second time during performance of the recall test and a third time during the transfer test. These three measures were viewed *vis-à-vis* test performance in order to see if the degree of familiarity of the learner with the narrator in MM materials has any influence on learning and on performance of the tests.

The following figure (Figure 3-2), visualises mental effort on learning and task performance in relation to learning process efficiency as suggested by Paas, et al. (2003):

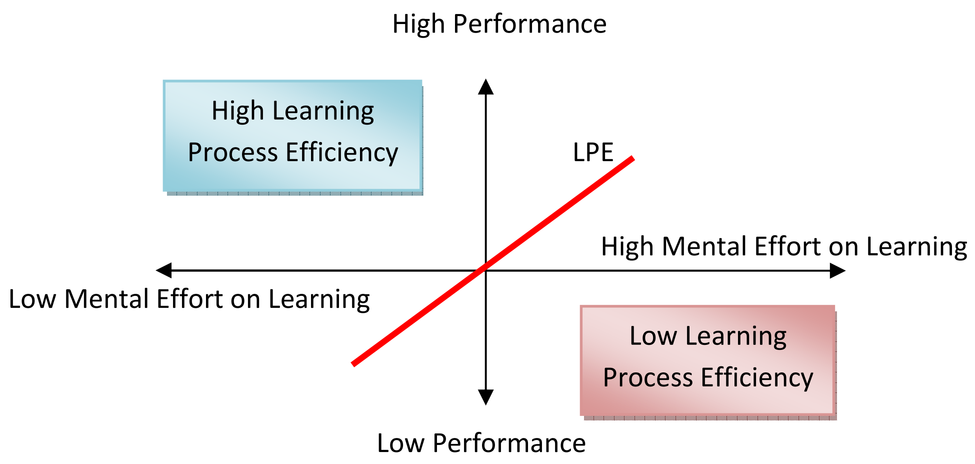

Figure 3-2: Mental effort – performance coordinate system for Learning Process Efficiency (LPE)

The above two calculations (TE and LPE) assume a two-dimensional approach which combines measures of test performance with measures of the associated mental effort in order to compare the efficiency of the instructional conditions. Another approach was also proposed which combined the measures of learning mental effort, test mental effort and test performance – a three-dimensional approach (Tuovinen and Paas, 2004). In the two-dimensional task-efficiency (TE) calculation, the cognitive load during the learning phase is disregarded and in the two-dimensional learning process efficiency (LPE) calculation, the cognitive load during task performance is disregarded. In the three-dimensional, approach both learning cognitive measures are taken into consideration. The rationale for the three-dimensional approach is that two learners may encounter the same level of cognitive load during learning and come up with the same performance level, but experience different levels of cognitive load during task performance. In this case, provided the same mental effort was exerted during learning, the student who attained that performance level with less mental effort during the task had gained a better knowledge of the content. Thus, the three dimensional approach provides an additional insight into efficiency measurement.

The three-dimensional efficiency measure (3D-E) incorporates both learning process efficiency (LPE) and test efficiency (TE) in one measure; thus, we get a more complete measure of the instructional process efficiency (Tuovinen and Paas, 2004).

The formula for calculating this index is:

Equation 3-3: Three Dimensional Efficiency

$$\mathbf{3D - E} = \frac{\boldsymbol{ZTaskPerformance - ZLearningMentalEffort - ZTaskMentalEffort}}{\boldsymbol{\sqrt{3}}}$$

Where:
3D-E - relative ***Three-Dimensional Efficiency*** of a learning situation
$\boldsymbol{ZTaskPerformance}$ - Standardised z-score of ***task performance*** measurement
$\boldsymbol{ZLearningMentalEffort}$ - Standardised z-score of ***mental effort of learning*** measurement
$\boldsymbol{ZTaskMentalEffort}$ - Standardised z-score of ***mental effort on task*** measurement

The above three calculations, i.e. LPE, TE and 3D-E, serve as diagnostic tools to differentiate between the efficiency of various instructional designs. The following figure (Figure 3-3), visualises mental effort on learning, mental effort on task and task performance in relation to the three-dimensional learning efficiency as suggested by Tuovinen and Paas, (2004):

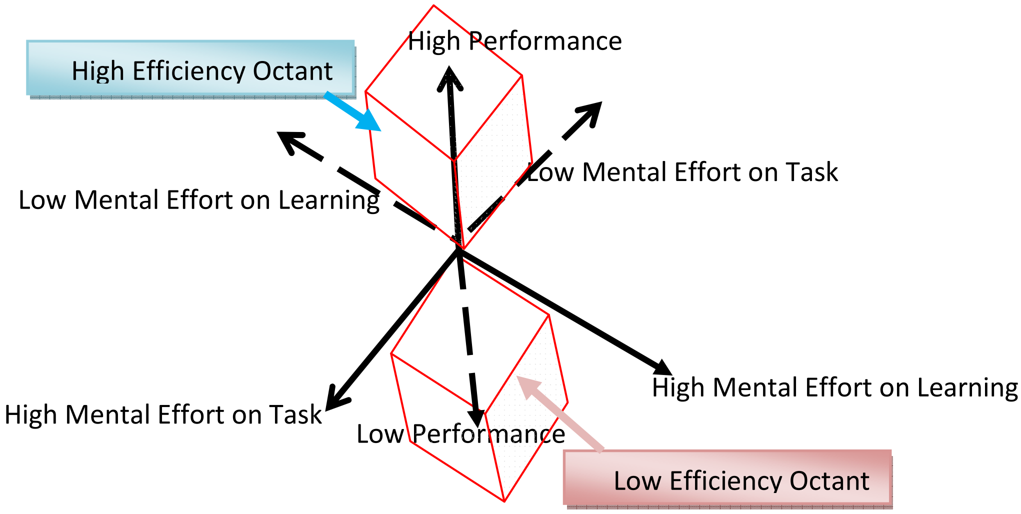

Figure 3-3: Mental effort – performance coordinate system for Three-Dimensional Efficiency (3D-E)

3.1.5 Cognitive Load Theory and motivation

In this section, motivation is discussed from the perspective of cognitive load theory and a calculation for measuring motivation on task is introduced as a function of mental effort and task performance. In section 3.9 motivation will be further discussed as part of personality characteristics that may differentiate between students, mainly in relation to ***conscientiousness*** and ***test anxiety***.

Motivation is considered to be a mediating element that influences the perception of cognitive load (Paas, 1992; Paas and van Merriënboer, 1994b). Motivational factors can affect learning by raising or lowering the cognitive intervention and it may be affected by affective reactions to learning material (Astleitner and Wiesner, 2004; Carstensen and Mikels, 2005; Moreno, 2005; Paas, Ayres and Pachman, 2008; Um, et al., 2011). Paas and Van Merriënboer (1994) claimed that if learners are not motivated and do not invest mental effort in a test, instructional designs aimed to bring the cognitive load to an optimal level will not have much effect. In attempting to arrive at an optimal cognitive load it is important to avoid both overload and under load, which affect learning adversely, while also reducing extraneous load and increasing germane processes (Paas, Renkl and Sweller, 2003; 2004; Paas and Van Gog, 2005). These researchers also claimed that very few researchers had examined the subject of motivation, since most of the studies were conducted under laboratory conditions. Under these conditions the students had a greater predisposition to invest mental effort than under natural learning conditions, i.e. the *Hawthorne effect* (McCarney, et al., 2007), in order to please the examiners or because they had been paid. Learners act differently under natural learning conditions and research into such conditions can shed additional light on the connection between motivation and cognitive load. Thus, since the emphasis in the present research was on a situation of natural learning in order to reduce as much as possible the artificial side effects of the laboratory setting, it facilitated the investigation of the motivational aspect of cognitive load as well.

In the present study, conducted in the natural learning environment, the students experimented with MM learning materials with various narrations during class exercises, which also accredited them with two points (out of 100) in the final course grade. Thus, their motivation to perform well was not related to artificial conditions of an experiment. With regard to the students being assessed, which might raise an issue of power relationship, they were notified (see Appendix K) that they could achieve these two points doing the same task at home if they wished not to take part in the experiment.

Paas (1992) and Paas and Van Merriënboer (1994) defined mental effort as the amount of cognitive resources that are directed towards learning or performing of a task. This definition proposes that the amount of mental effort that is invested in performance of a task can serve as a trustworthy estimate of the learner's involvement in the task or in other words, their motivation. According to them, the amount of mental effort invested is regarded as a more accurate indication of motivational behaviour than self-report methods, in which learners are asked to indicate the level of motivation as perceived by themselves (Song and Keller, 2001). However, since not all the learner's cognitive resources are oriented to the task, the mental effort index is not sufficient. Thus, in order to calculate with greater accuracy the level of motivation invested in the performance of any task, it is not only the mental effort invested in it that should be taken into consideration but also the level of performance (Paas, et al., 2005).

Assuming that the combination of mental effort in performance of a task and performance scores is a more accurate measure of motivation in task performance than the self-reported scale, Paas, et al. (ibid) proposed a calculative model for measuring the motivation of the learner in performing a task. This model is based on the assumption that there is a positive connection between mental effort, performance and learner's motivation. If so, the combination of mental effort and performance scores can provide information on the relative involvement of students in the learning conditions and can serve for a comparison of the influence of learning conditions on their motivation. A high level of task performance associated with high mental effort is referred to as high involvement in the task. A low level of task performance associated with low mental effort is referred to as low involvement in the task.

The formula proposed by Paas, Tuovinen and van Merriënboer (2005) for determining instructional involvement, i.e. motivation on task, is:
Equation 3-4: Motivation on Task

$$\mathbf{MT} = \frac{\boldsymbol{ZTaskMentalEffort + ZTaskPerformance}}{\sqrt{\mathbf{2}}}$$

Where:
MT – Relative ***Motivation on Task***
$\boldsymbol{ZTaskMentalEffort}$ - Standardised z-score of ***mental effort on task*** measurement
$\boldsymbol{ZTaskPerformance}$ - Standardised z-score of ***performance of task*** measurement

It was found that a direct relationship exists between motivation, mental effort and performance among novice students and that an inverse relationship exists among students who are experts~*The Expertise Reversal Effect* (Kalyuga, et al., 2003; Yeo and Neal, 2006; Kalyuga, 2007). Thus, the proposed formula reflects results for novices more accurately than it does for experts. As a reminder, in this research, participant students were all novice, since they either failed or refrained from doing the exemption test in the beginning of the course. According to Paas, et al. (2005), this measure can help in identifying the learning condition that enhances the learner's motivation to invest more mental effort and achieve better performance, or invest less mental effort and achieve poorer performance. However, the difficulty of the task represents only one of three dimensions that define mental effort invested in performing the task. The other two are the learner's traits and the interaction between the learner and the task. So long as the task is not too difficult or too easy, the learner will be willing to invest more mental effort and the scoring on task performance will have a higher correlation with the scoring on mental effort invested in it.

Moreover, according to Paas, et al. (2005), in cases where the relative efficiency does not distinguish between two different instructional conditions, say, if they are both found to be efficient, other factors must be taken into account. One of the assumptions that served as the backdrop for development of the task efficiency formula was that learners are motivated to perform the task. Therefore, if there is no difference between the task efficiency (TE) of two instructional designs, the better design will be that in which the learners showed greater involvement.

However, MT calculation is not free of concerns. As its developers state, there might be cases in which students can make trade-offs between mental effort and task performance and achieve the same level of MT. Furthermore, the MT computation suggests that it depends on the amount of mental effort that a student invests in performing the task. Nevertheless, since the formula sums the amount of mental effort and task performance it may happen that given an equal level of mental effort task performance will be the factor that will determine the relative difference in motivation on task between the learning conditions under study.

In the present research, mental effort during learning with NVSC and during performance of a subsequent test was measured, together with task performance. The calculated motivation (involvement on task) allowed comparing students' motivation in the different MM learning designs. The following figure (Figure 3-4), visualises mental effort on task and task performance in relation to the motivation on task as suggested by Paas, et al. (2005):

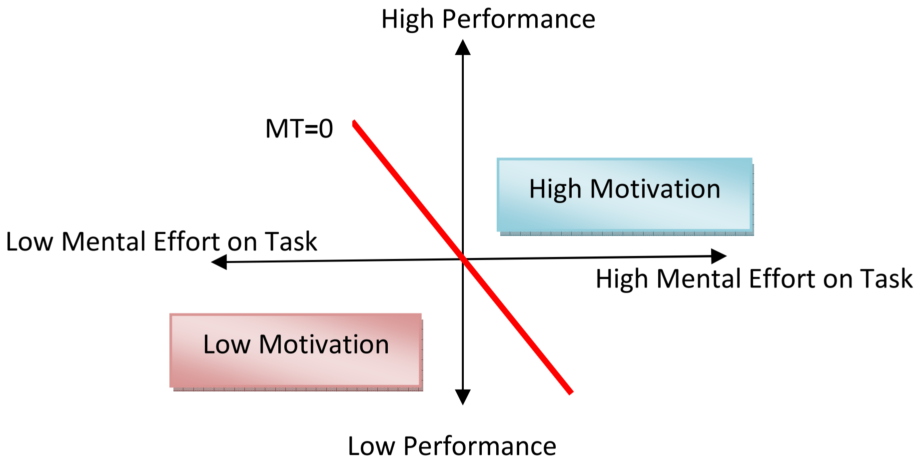

Figure 3-4: Mental effort – performance coordinate system for motivational effects of instructional conditions (MT)

3.1.6 The Computer Literacy course from the perspective of cognitive load

Research in cognitive science indicates five kinds of knowledge: factual knowledge, conceptual knowledge, procedural knowledge strategic knowledge and beliefs (Anderson and Krathwohl, 2001; Mayer, 2011a). ***Computer Literacy*** course teaches skills relating to computer use for academic purposes, like using a word processor for writing academic assignments, creating effective presentations, using a spreadsheet for manipulating collected data for research and searching the internet for topics of interest. Thus, part of the knowledge learned is factual, like getting to know the different kinds of search engines and databases of academic journals, another kind of knowledge is strategic like producing well organised academic papers or presentations and part of the knowledge is procedural when studying the functions and procedures of the different software (e.g. MS Word, MS PowerPoint and MS Excel).

Procedural learning is a widely accepted concept in the study of skills required for work with the computer. Procedure is constructed from a series of steps that explain how to carry out a certain task (Pierce, et al., 1993; Zacks and Tversky, 2003; Arguel and Jamet, 2009). Procedural learning in the study of skills for work with a new program involves a high level of element interactivity, for procedural learning emphasises learning of skills and steps that must be executed in a given sequence in order to proceed from the start to the end state. In addition to the procedural steps, instruction must also include supporting knowledge such as the purpose of the procedure and the rationale behind its execution. According to CLT, high interactivity between the elements in the subject matter studied creates a load on the WM of the intrinsic cognitive load type, which thwarts learning (Sweller, van Merriënboer and Paas, 1998; Paas, Renkl and Sweller, 2003). However, as noted before, in recent years it is emphasised that element interactivity underlies not only intrinsic load, but also extraneous and germane cognitive load (Beckmann, 2010; Sweller, 2010; Sweller, Ayres and Kalyuga, 2011). According to these authors, extraneous cognitive load depends on whether element interactivity is essential to the task at hand or whether it is a function of instructional procedures. That is, if element interactivity can be reduced without altering what is learned, the load is extraneous; if element interactivity can only be altered by altering what is learned, the load is intrinsic. Intrinsic and extraneous cognitive load are also determined by the learner's expertise, i.e. the same level of element interactivity may be considered high for a novice and low for an expert (Sweller, 2010). In contrast, germane cognitive load refers to the WM resources that the learner allocates to dealing with the intrinsic cognitive load associated with the task at hand.

In relation to ***Computer Literacy*** course, during a frontal lesson, students may experience cognitive load of the extraneous type. Lessons in computer skills are generally delivered in one of two ways: the teacher presents the material with the students' screens locked, while from time to time the teacher unlocks the screens to allow the students to practise the material. Alternatively, the material is presented on an overhead screen, with the students listening to the teacher, viewing the sequence of operations he/she is performing on the overhead screen, looking at their own keyboard in order to perform the operations themselves and viewing their own screen in order to make sure that they are executing the operations correctly.

In the first form of instruction, where the teacher performs demonstrations with the students' screens locked, the students are required to do the following: listen to the teacher, passively follow the sequence of operations they are performing and then remember the sequence of operations demonstrated after the instructor unlocks the screen and perform them on their own computer. If the students had made a written note of the operations, they would have to read it to perform the required operation and also pay attention to the keyboard and to the result on the screen. If they had not made a note of the instructions, they would have to repeat the entire operation from memory. Nevertheless, according to Sweller and Chandler (1994), in order to lessen the extraneous load during initial learning it is preferable to neutralise the possibility of working with the computer altogether during the instruction and allow the student to view the teacher's demonstration screen passively. This method is used in the classroom during the Computer Literacy course where the research took place, i.e. the students' computers are locked using the software NetopTM, (Exsys, n.d.) and the students view the teacher's demonstration, which is accompanied by verbal explanations.

The approximate human attention span is up to 20 minutes and often less (Bunce, Flens and Neiles, 2010) and according to Medina (2008), human attention span is limited to about 10 minutes, after which, people begin to get restless. Thus, for longer face-to-face lectures, the author suggests placing ‘hooks’, e.g. raise anticipation for some aspect of content, that may attract the attention of the students. The computer literacy classes, where this study took place, last 90 minutes, thus lecture time was divided into four to five segments of 15-20 minutes each. The lecture segments consisted of demonstration segments and hands-on practice interchangeably. According to Bunce, Flens and Neiles (2010), such variation is optimal for keeping students engaged in class. 'Hooks', as suggested by Medina(2008), were introduced in the form of relating each segment to an actual course essay the students were asked to submit in other courses. The anticipation of studying a skill that had immediate relevance in handling an actual task helped keep the students more attentive to the demonstrations. Thus, each demonstration segment consisted of introducing a real problem the students were facing, demonstrating the procedures they had to master and then demonstrating how these new skills could facilitate their courses' assignments. The hands-on session which followed served as a break which enabled another demonstration session with another authentic problem. Relating the demonstration subject to a real problem enabled raising the students' interest and awareness and thus maintained their attention since according to Medina (2008), interest or importance is inextricably linked to attention.

The students in the ***Computer Literacy*** course have a knowledge of computer applications that is entirely superficial: they have never participated in a proper course of study; they use MS Office™ software in a sketchy, minimalistic manner, e.g. they use very little of what the software has to offer, with MS Word for instance, they do not know how to create an automatic content table, how to customise tabs or margins or how to manage footnotes etc. They have practically picked up knowledge through trial and error. They are therefore considered novices. Moreover, a large part of the skills that they have acquired is inefficient and even hinders activation of the more advanced functions of the software. According to the *Einstellung Effect* (Luchins and Luchins, 1970; Flemming, Bhavnani and John, 1997; Bhavnani and John, 2000), which refers to a person's predisposition to solve a problem in a specific way even though there are more appropriate ways of solving it, they not only have to learn computer skills from scratch, but also have to contend with the need to unlearn previous habits that they had acquired through trial and error and that prevent them from intelligent use of the programs. From CLT perspective not only do they not yet have the appropriate schemas in their LTM, they must also cope with inappropriate existing schemas, which they use automatically when a particular subject is learned; this hinders the study of proper skills, since erroneous schemas are loaded on the WM, disrupting the learning process. The purpose of a well-organised ***Computer Literacy*** course is to impart proper computer skills to the students and assist them in constructing proper schemas that will help them to learn the new subjects and use the advanced software functions. In this respect, the ***Computer Literacy*** course may be characterised as imposing a high intrinsic cognitive load. In the present research, the emphasis was placed on examining the influence of the probable extraneous load caused by designing MM learning materials to serve as auxiliary course materials. More specifically, an examination was carried out to see if learning material with narration in a voice that is unfamiliar to the students raises the extraneous load and therefore hinders learning.

Many researchers have shown that instructional design and differences between different instructional designs find particular expression when the studied material involves a high level of interaction between its component elements, i.e. when there is high intrinsic cognitive load (Sweller and Chandler, 1994; Chandler and Sweller, 1996). When the intrinsic load is high due to high element interactivity, greater significance is attached to the reduction of extraneous load through proper design of the learning materials. It should be noted, that in subjects where the intrinsic load is not high, i.e. interaction between the various elements is relatively low; there is relatively less significance to instructional design and to reduction of the extraneous load (Sweller, 2010).

Sweller and Chandler (1994) proposed two possible factors causing difficulties in the learning of a particular subject:

1. Interrelation between substantial parts of the information which must be performed simultaneously, i.e. interaction between different items of information;
2. The presence of a large number of interrelated elements that must be executed in a particular sequence, creating an intrinsic load, which is a problem in many of the subjects that are studied in the ***Computer Literacy*** course;

As an example, a basic item of information in computer applications can be use of the ***delete*** key to erase a certain character or to cancel a specific operation by choosing the ***undo*** button. These basic operations are independent, they entail only one element and they do not require the application of additional knowledge; the intrinsic load that their operation involves is therefore low. However, performance of an action such as definition of a multilevel list requires a sequential performance of several elements.

For example, the steps for defining a multilevel list in MS Word:

1. Start a multilevel list by clicking the arrow of the multilevel list button;
2. Press ‘define multilevel list’;
3. Click level to modify;
4. Choose number style;
5. Enter formatting for number;
6. If level number is higher than 1, press ‘include level number from....’;
7. Choose levels to be included;
8. If there are still more levels to be formatted, repeat steps 3, 4, 5, 6, 7 for next level;
9. If finished press the ‘OK’ button;

Since interaction occurs between all the above actions, the intrinsic load is relatively high and a load is created on the WM.

As this procedure cannot be changed, i.e. it is not possible in this case to influence the intrinsic load and as the load created on the WM is accumulative and is influenced by the intrinsic and extraneous load, the aim is to reduce the extraneous load created by the manner in which the subject is presented to as great an extent as possible, i.e. by designing the material such as to render learning more efficient.

In the context of this research, as stated earlier, the learning of advanced computer skills involves high element interactivity. Thus, it is important to examine whether, assuming all other variables to be identical, listening to an unfamiliar voice in MM study materials increases the students' extraneous load, possibly causing a high cognitive load, while taking into consideration the already existing intrinsic load as a result of the type of subject matter. Appendices F, G and H of the recall and transfer tests, exhibit also the detailed description of element interactivity involved in each of the tasks, as suggested by Sweller (2010).

NVSCs, which were used in this research, comprised example modelling and are, usually, intended to assist the students during revision of the material at home or for catching up missed lessons. By using example modelling, an expert in the field can demonstrate how to perform the required skill (Renkl, et al., 1998; Renkl, et al., 2003; Gee, 2010; Kyun, Kalyuga and Sweller, 2013). Furthermore, NVSCs allow the teaching of subject matter that is easier to show than to explain in words. Teaching of skills in the use of computer software is still considered a challenge, even to seasoned computer users, not to mention new users. In order to learn a program effectively, the student must know how to navigate it and derive the desired results. Proficiency in the use of new programs requires learning and memorisation of numerous details; therefore, learning materials that consist of example modelling, including live demonstrations on the screen accompanied by audio explanations, are considered an appropriate solution for this field of knowledge. Research studies that deal with cognitive load theories have found that this kind of teaching allows more efficient construction of cognitive schemas and better performance in transfer tasks, especially in fields of knowledge related to the acquisition of skills (Carroll, 1994; Paas and van Merriënboer, 1994b; Renkl, et al., 1998; Tuovinen and Sweller, 1999; Atkinson, et al., 2000; Renkl, et al., 2003; Paas and van Gog, 2005; Gerjets, Scheiter and Catrambone, 2006; Rourke and Sweller, 2009).

NVSCs furnished as auxiliary materials to students were created in order to provide an answer to a need that arose with students to revise material studied in the class. NVSCs are intended to facilitate learning with less cognitive load, allowing students to view them passively in front of the computer. The advantage provided by NVSC is that it allows learning at one's own personal pace with the possibility of going back, or practicing actions simultaneously (with the help of a split screen) for students who feel that they are already ready for it.

To summarise, an intrinsic load exists in the ***Computer Literacy*** course due to high element interactivity, stemming from the nature of the subject matter in courses such as this. Therefore, great importance is attached to examining the instructional design of the auxiliary materials in the course in order to ensure that the extraneous load is under control, as well as to preventing the students from encountering situations that could raise their extraneous load.

This section reviewed CLT from the point of view of cognitive load created in learning in general and learning of ***Computer Literacy*** in particular. In accordance with CLT, the present research sought to examine whether the familiarity of the student with the narrator in MM study material has an influence on task performance efficiency, the efficiency of the learning process and motivation on task. The following section will discuss CTML, which stems from CLT with relation to MM learning.

3.2 Cognitive Theory of Multimedia Learning

The MM learning environment is an extremely complex one and is therefore very sensitive to external design features. The variables present in MM learning environments are greater in number than in print learning environments (Mayer, 2005a; Homer, Plass and Blake, 2008). The use of different sensory modalities can help in learning and in creating elaborated schemas in the LTM and can also expand the resources in the WM by careful use of visual, auditory and sensory channels. However, if not designed properly, MM learning materials might have a negative effect on the learner's cognitive load. Therefore, a careful examination must be conducted to see which combinations of media we use in learning materials and the dose of each (Mayer, 2005a).

The current study examined NVSCs, which are MM learning materials. These learning materials were developed to meet research-based criteria for effective MM learning. The next review will describe a number of criteria that were found to affect the effectiveness of MM learning material from a cognitive load perspective.

Numerous studies suggested several effects that influence learning in the MM environment. According to the *Modality Effect***,** when a learner is presented with a picture or an animation accompanied by a verbal explanation, the explanation must be oral and not written (Moreno and Mayer, 1999; Tabbers, Martens and van Merriënboer, 2004; van Gerven, Paas and van Merriënboer, 2006). The assumption is that the WM consists of two modality-specific slave systems, one for visual-spatial information and the other for acoustic information. When information is presented in two sensory modalities (visual and auditory) instead of in one, both the slave systems spring into action and thus, the total WM capacity is utilised in a more efficient way. Thus, the extraneous load of the MM explanations is then lessened (Mayer and Moreno, 1998; Baddeley 2003). To be more specific, when we present a picture and written text, both these media are processed in the visual-spatial channel and therefore they will increase the load on this channel. In contrast, when the text is narrated the auditory channel is also actuated, the load on the visual channel is relieved and thus, the extraneous load is also lessened. Numerous research papers support the theory according to which narrated text is preferable to written text in MM learning (Mayer, 2005a; Nass and Brave, 2005).

The theories underlying the *Modality Effect* are the ***Dual-Coding Theory*** of Paivio (1986) and the ***Working Memory Model*** of Baddeley (1992). According to ***Dual-Coding Theory***, there are two cognitive subsystems, one for dealing with non-verbal information and the second one for dealing with verbal information. A combination of verbal and non-verbal content increases retrieval from the LTM because this combined display encourages the process of dual coding and the integration of two types of information. According to ***Working Memory Model,*** WM is divided into a 'visual-spatial scratch pad' for processing visual information and a 'phonological loop' for processing auditory information and these two systems are controlled by a 'central executive' (Mousavi, Low and Sweller, 1995; Tindall-Ford, Chandler and Sweller, 1997; Kalyuga, Chandler and Sweller, 1999; Liu, et al., 2012).

One of the first learning theories to adopt these theories was the CLT (Sweller, et al, 1998; Sweller, 1999; Paas, et al, 2003; Paas, et al, 2004). CLT points to the limited capacity of the WM and proposes dual stores in order not to create an overload on one of them. The theory suggests presenting graphic rather than verbal information in visual form and the accompanying text in auditory form in order not to overload the capacity of the WM.

However, other researchers claimed that the explanation for the decrease in the extraneous load when information is presented in two channels is that, when the text is presented in narrative instead of written form, there is a reduction in the visual search the learner must perform in an attempt to connect the picture with the text (Mousavi, Low and Sweller, 1995; Tindall-Ford, Chandler and Sweller, 1997). If printed text is used with animation or diagrams, the learner must perform searches between two different displays. If both these sources of knowledge are necessary for an understanding of the material, then the learner's attention is divided between the two sources of information. This effect is referred to as the *Split Attention Effect* (Ayres and Sweller, 2005). Secondly, use of two displays can create a *Redundancy Effect* (Moreno and Mayer, 2002; Sweller, 2005b). This occurs when two sources of information, visual and verbal, replicate some or all of the information, for instance, when a narrated text is accompanied by a written text displayed on the screen. The learner must then decide which information to internalise and which is redundant. This process causes a rise in the extraneous cognitive load. Therefore, in order for the *Modality Effect* to act maximally, both the *split attention* and *redundancy* must be avoided when designing MM instructional materials. If the visual information is accompanied by narrated text, the learners do not need to split their attention between interconnected visual and textual information and thus, the *Split Attention Effect* is avoided.

It was found that video demonstrations encourage more relevant internal representation of the learning material. Tversky, Morrison and Be´trancourt (2002) explained this effect by the *Congruence Principle* which happens when the external presentation as it is displayed by the learning material is essentially close to the internal representation (Schnotz and Bannert, 2003) required for the understanding of the content. Therefore, the use of video recordings including NVSCs, of which use was made here, is very appropriate for teaching content areas with elements that change over time, for example, phenomena that change over time (Tversky, Morrison and Betrancourt, 2002; Betrancourt, 2005), or description of sequential actions that cause change (Zacks and Tversky, 2003; Jamet, 2008; Jamet and Arguel, 2008). However, it should be noted that several studies have shown that dynamic views are not always better than the static ones when referring to the learning outcomes (Park and Hopkins, 1993; Betrancourt and Tversky, 2000; Mayer, et al., 2005; Höffler and Leutner, 2007; Imhof, Scheiter and Gerjets, 2011). Moreover, Tversky, Morrison and Betrancourt (2002) show, in their review, that in the cases where dynamic views were better, it was because they included more information than the static ones.

Based on the above principles, Mayer, Heiser and Lonn (2001) developed the ***Cognitive Theory of Multimedia Learning*** (CTML). This theory emphasises the integration of audiovisual information on the level of the WM. The process of integration is cognitively demanding and is at the expense of mental resources that could be channelled to the learning process. The theory describes how the learner constructs a mental representation of the MM instructions. A number of principles have been proposed, based on this theory, that are intended to guide designers of MM learning environments and avoid the effects of *Split Attention* and *Redundancy* (Mayer and Moreno, 2003). Several CTML principles for design of the MM environment were proposed (Mayer, 2005a), most of which were found to be applicable to the NVSC:

1. *Multimedia Principle* – students learn better from words and pictures than from words only;

2. *Spatial Contiguity Principle* – students learn better when the pictures and associated words are present close to each other;
3. *Temporal Contiguity Principle* – students learn better when the pictures and words are displayed next to each other rather than in succession*;*
4. *Coherence Principle* – students learn better when unnecessary content, e.g. unnecessary text, pictures or background sound effects, is not included in the MM environment, as it could constitute a distraction;
5. *Modality Principle* – students learn better from animation and narration than from animation and text on the screen;
6. *Redundancy Principle* – students learn better from animation and narration than from animation, narration and text on the screen;
7. *Individual Differences Principle* – the effect of designing the instructional environment is more significant for students with low knowledge than with students having knowledge of the subject and for high-spatial students than for low-spatial students, i.e. only learners with high spatial vision can benefit from visual and verbal materials that are presented in succession, i.e. first the visual material and then the verbal explanation (Mayer, et al., 1996; Mayer, Sobko and Mautone, 2003).

Both CLT and CTML deal with educational intervention which has a direct influence on the WM and consequently on the LTM (Sweller, 2010). In this study, NVSCs were made in accordance with the relevant principles of MM design proposed by researchers (Mayer, Heiser and Lonn, 2001; Mayer, Sobko and Mautone, 2003; Mayer, 2005a), so that they were supposed to help students to cope with the cognitive load created while learning the various computer skills. Nevertheless, there is still a question whether there is significance to the familiarity with the narrator, or perhaps any MM learning material found in various relevant databases can equally help students.

3.2.1 Narrated video screen captures and multimedia design principles

NVSCs, used here, met the criteria described above and the only additional variable to be checked was the influence of the familiarity or lack of familiarity with the narrator on students' mental effort and performance. The NVSCs conform to the recommended MM instructional design criteria as follows:

1. *Multimedia Principle* - NVSCs include video screen captures and narrated words;
2. *Spatial Contiguity Principle* –in NVSCs, the only visual component are the video screen captures;
3. *Temporal Contiguity Principle* - in NVSCs, pictures and narration are presented in contiguity;
4. *Coherence principle* – in NVSCs, no additional content, graphics or background music, besides video screens and narration is presented;
5. *Modality Principle* – NVSCs include video and narration;
6. *Redundancy Principle* – in NVSCs, no additional text is shown on screen;
7. *Individual Differences Principle* – all students under study were novices in regard to the subjects introduced;

As regards the *modality principle*, a study that was conducted in a natural learning environment (Tabbers, Martens and van Merriënboer, 2004) identified a *Reverse Modality Effect.* In this study, replacement of the written text with narrated text actually caused a drop in the students' retention and transfer scores. The researchers concluded from this that this effect, based on the laboratory tests, cannot be generalised to include natural learning situations. An additional explanation given was that the reverse finding might have been obtained because MM learning in this research was learner-paced whereas other research confirmed the modality effect learning was system-paced. In other words, the pace of narration governed the time given to the student to examine a picture and accompanying text.

One of the problems in the use of animation in MM *versus* static graphics is that the students must cope with transient information. In other words, in attempting to cope with the information that is presented at a given moment on the screen, the students must also try to remember the information that was presented earlier and that is there no more, affecting their cognitive load (Sweller and Chandler, 1994; Betrancourt, 2005; Ayres and Paas, 2007; Hasler, Kersten and Sweller, 2007; Amadieu, Mariné and Laimay, 2011; de Koning, et al., 2011; Spanjers, et al., 2011). One solution to this problem can be found in enabling the student to control the learning environment by stopping the presentation, backtracking and fast-forwarding. NVSCs used in the study addressed this concern as well, since they were operated by Windows Media Player™ software that allowed the students control over their learning pace. The students could stop and rerun the video and learn at own pace.

The NVSCs' architecture conforms to the design principles of MM materials suggested by CTML (Mayer, 2005a). Thus, the assumption was, that for the purpose of learning computer skills they are effective learning materials and the only factor left to examine is whether a familiarity on the part of the students with the narrator affects their extraneous load and thus, their cognitive load and, in turn, their learning.

3.3 Cognitive-Affective Theory of Learning with Media

This study sought to reveal the impact of the familiarity with the narrator in MM learning material on learning, also in the light of students' personal characteristics, which might affect motivation and performance, i.e. **conscientiousness** and **test-anxiety**. The main reason for integrating personal characteristics into this research was to add another dimension to mental effort measurement, test performance and the various calculations derived from it. Adding the affective dimension of students' traits to the study is easily understood in the light of the affective learning condition due to the personal connotation familiarity with the course instructor adds to students' interaction with the MM learning material.

The ***Cognitive-Affective Theory of Learning with Media*** (CATLM) was first introduced by Moreno (2005), who suggested an integrative model, based on learning science principles, where cognitive processing is the result of the interaction between the learner's knowledge, abilities, beliefs, affect and motivation (Moreno, 2005; Moreno and Mayer, 2007). Motivation is a process by which goal-oriented behaviour is initiated as a result of affective situations (Pintrich and Anderman, 1994; Pintrich, Roeser and de Groot, 1994; Pintrich and Schunk, 1996). The integrative model states that in performing a task, learners posses a certain amount of cognitive resources but motivation, initiated by affective stimuli at that time, determines the actual amount of cognitive resources they will invest in the task. Thus, it is the actual amount of cognitive resources used, rather than the cognitive capacity that affects learning (Moreno, 2008).

CLT does not take into account the learners' personal characteristics and the affective conditions, which might affect their readiness to allocate cognitive resources to a certain task in a certain affective situation (Busato, et al., 1998; Chamorro-Premuzic and Furnham, 2005; O'Connor and Paunonen, 2007; Chamorro-Premuzic and Furnham, 2009).

In fact, in some studies, findings did not match the predictions made according to CLT and the inferred conclusions were criticised stating that the theory allows different and contradicting possibilities to explain empirical results (Schnotz and Kürschner, 2007). However, research showed that germane cognitive load depends also on affective and motivational characteristics of learners (Entwistle and Ramsden, 1983; Marton and Saljö, 1984). Thus, research suggested that there are more variables interacting in the learning process affecting cognitive load and performance (Schnotz and Kürschner, 2007; de Jong, 2010; Moreno, 2010). In the light of the new formulation of CLT suggested by Sweller (2010), it might be said that affective and motivational characteristics affect the learner's willingness to allocate WM resources to germane processes. Thus, this study tried to address this issue by integrating personal characteristics, i.e. **conscientiousness** and **test-anxiety**, which were found to be adversely correlated with motivation and academic achievement (Pintrich, et al., 1991; Costa and McCrae, 1992a) into the research, as also suggested by Mayer (2005a) and Moreno (2010). These characteristics will be further discussed in section 3.9.

3.4 Social Agency Theory

This section presents a review and a discussion of the principles of ***Social Agency Theory*** as a background to the subject of the research and its connection with other theories, upon which the research was based and which were reviewed in the previous sections.

This study dealt with a learning environment, which includes weekly face-to-face meetings and on-line MM learning material. The assumption was that students create a kind of social contact and personal relationship with the course instructor. Thus, it is appropriate to investigate the effectiveness of MM learning material with different narrations from the ***Social Agency Theory*** perspective.

Social Agency Theory, (Atkinson, Mayer and Merrill, 2005) follows the ***Media Equation Theory*** of Nass and Reeves (1996), which deals with the way people relate to computers, television and new media as real people. According to the ***Media Equation Theory***, MM learning environments can be designed such that they will encourage learners to act under the assumption that a social relationship exists between them and the computer (Nass and Reeves, ibid). The theory claims that the use of verbal and visual social cues in computer-based environments causes learners to feel that the relationship between themselves and the computer is similar to that between two people. Research found that learners respond to verbal social cues that reach them from computers in exactly the same way as they would to the same social cues if the source were people (Nass, et al., 1995; Nass and Moon, 2000). In other words, MM courseware can provide information that is not an integral part of the studied subject matter but rather information that imparts a feeling of social interaction. Software that allows the learner to identify certain people, including their personalities and other personal details relating to them, pass on social cues that are above and beyond the literal content of the subject matter. For example, a lecture on video by Stephen Hawking delivers information relating to the subject matter of the lecture, but also additional messages relating to Hawking himself – his personality, his communication media, the disability with which he must cope, etc. (Hoadley and Kirby, 2004).

Social Agency Theory claims that the more social cues students receive while interacting with a MM learning material the less cognitive load they experience, which results in a more efficient learning process (Moreno, et al., 2001; Mayer, Sobko and Mautone, 2003; Atkinson, Mayer and Merrill, 2005; Mayer, 2005b).

It was assumed here, that students would receive more social cues, from courseware in which the narrator is their familiar teacher. Moreover, in accordance with ***Social Agency Theory***, it was assumed that the social cues that the students receive in interaction with the learning material might affect their cognitive load and the efficiency of the learning. Thus, it was hypothesised that MM materials that are given to students with narration by a teacher with whom they are familiar will result in learning that is more efficient. Following is a model demonstrating the effects of social cues on learning as suggested by Mayer (2005b):

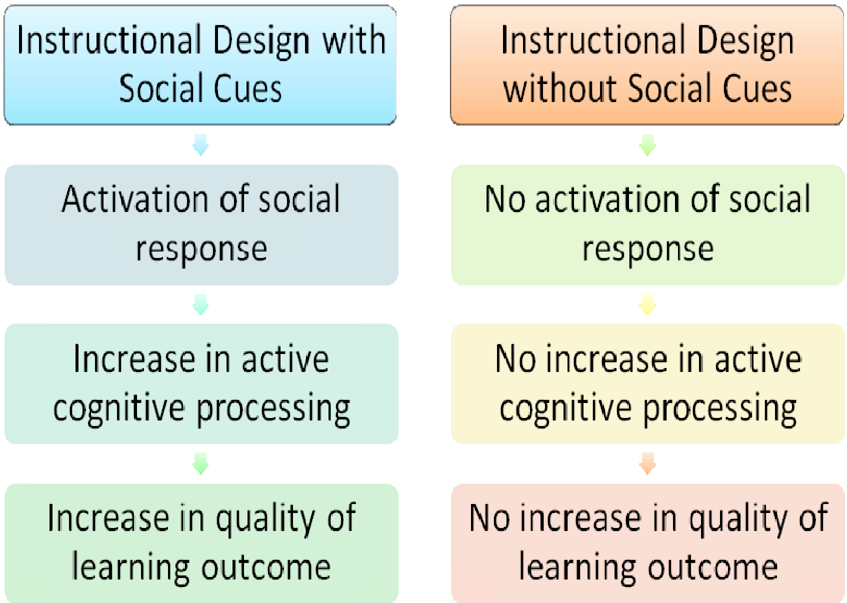

Figure 3-5: The effects of the presence and absence of social cues on learning

This research sought to examine if the degree of familiarity of the learners with the narrator influences their cognitive load and thus, the efficiency of learning. Based on ***Social Agency Theory***, the assumption was that with a familiar narrator social interaction, being part of the biologically primary knowledge (Kalyuga, 2011c), will occur automatically and unconsciously, thus, leave more WM resources for handling essential intrinsic load. With an unfamiliar narrator, establishing a social interaction with the computer will require more mental effort, thus, inducing extraneous load having negative effect on learning. Moreover, the assumption was that the more social cues students would receive from the NVSC, the more positive social interaction they would experience, thus, encouraging them to allocate more WM resources to generative processing.

3.4.1 The role of social cues in learning

According to the social cues assumptions, the conditions containing the most social cues will offer the greatest advantages. The moment a connection is struck with the computer through social cues, the learners can rely on a number of basic social rules that will guide their interaction with the MM environment (Mayer, Sobko and Mautone, 2003). The cognitive processes that the learner actuates in order to understand the educational messages include: (1) selection of relevant information; (2) organisation of information structures; and (3) integration of prior knowledge with new information. The ability to process information and understand it well will determine whether the learners will be able to transfer their learning in attempting to solve problems relating to the subject (Mayer, Heiser and Lonn, 2001; Moreno, 2008).

According to ***Social Agency Theory*** (Mayer, 2005b), activation of the social interaction schema will cause the learners to try to understand and process, in an in-depth manner the educational messages reaching them from the computer. Thus, the assumption was that a familiar voice will activate more easily the social interaction schema and as a result, students will be more motivated to learn. ***Social Agency Theory*** also aims to define the conditions under which learners interpret their interaction with the computerised learning environment. To be more exact, do learners perceive their experience with the computer as a situation of social interaction or of information transfer? The difference between these two perceptions will influence actuation of the learner's cognitive schemas, the level of cognitive processing and the quality of the learning. Learners will perceive the interaction as social interaction when they are able to receive the social cues required for creating person-to-person interaction with the computer. Such messages can be given by a friendly agent on the screen and a human voice. Perception of the computer as a social partner encourages the learners to try harder to understand the information they receive and increases the likelihood of positive transfer (Grice, 1975; Mayer, Sobko and Mautone, 2003). Since in this research it was assumed that adult students who study in a teacher-centred manner have a personal relationship with the familiar course instructor (Knowles, 1990; Donaldson, Flannery and Ross-Gordon, 1993) and assuming that interacting with MM learning material with a familiar narrator induces a positive interaction with more social cues than with an unfamiliar narrator, it was expected that students would show greater involvement during the learning phase and task performance. In other words, according to this assumption, MM learning material with a familiar narrator will affect students' motivation on task and thus, their performance.

Learning with the help of MM materials may be influenced by social cues transmitted by various sources; one example is the presence of an Animated Pedagogical Agent (APA), which is the narrator. An APA may be human or animated image; exhibited by the entire body or only the upper half. Many studies have been conducted on MM courseware that makes use of APAs (Moreno, et al., 2001; Atkinson, Mayer and Merrill, 2005; Moreno, 2007; Wang, et al., 2008; Mayer and DaPra, 2012). However, the importance of a virtual character being present on the screen was found to be controversial; some studies showed that the character contributes to social cues (Sproull, et al., 1996; Lester, et al., 2000; Kr¨amer, Bente and Piesk, 2003), while others concluded that it has no significance and that the character's appearance on the screen is immaterial (Hongpaisanwiwat and Lewis, 2003; Gulz, 2004; Mayer, 2005a; Fothergill, 2008; Mayer, 2011a). Moreover, there have even been studies that found that it constituted a disturbance to interaction between the learner and the computer in the sense that it diverted the learner's attention (Koda and Maes, 1996; Shneiderman, et al., 2005).

As shown before, the NVSCs used in this study met the principles of MM learning design suggested by Mayer (2005a), in order to prevent extraneous cognitive load and thus, allow germane processing (Mayer and Moreno, 2003; Mayer, 2005a). No use was made of APA, since this was not required by the subject matter, i.e. computer skills. The mouse pointer and narration plus screen casts provided all the required information. It follows, that the narration in the NVSCs was the only social agent available to the students.

All the studies conducted on MM materials from the perspective of ***Social Agency Theory,*** had examined the influence of the material in situations of self-learning, where the study material was the only source through which the student learned. Most of the research applied MM courseware accompanied by APA. However, the present research aimed to examine the influence of the familiarity with the narrator in MM materials without APA.

The research assumption was that students who are used to weekly interaction with a teacher who is instructing them in a particular subject would feel less comfortable if they learn new aspects relating to the same subject through MM materials featuring a narrator who is not the teacher with whom they are familiar.

It was further assumed that students form a mental image of their class teacher on hearing his/her voice, with all the accompanying visual social cues that accompany face-to-face interaction, such as body language, gestures and facial expressions (von Kriegstein, Kleinschmidt and Giraud, 2006). In this respect it might be said, in light of the ***Social Cognitive Theory*** suggested by Bandura (2001; 2002), which claims that learning is facilitated by observing experts display a certain skill, that students hearing a familiar narrator have the facility of 'observing' an expert, even though no human image is presented.

Thus, it was hypothesised that MM learning material with a familiar narrator would be more motivating because students would more easily enter a situation of dialogue and partnership with the narrator. This will drive them to make greater effort to understand the material, i.e. allocating more WM resources to germane processes and as a result showing better performance in recall and transfer tests (Mayer, 2011a).

3.4.2 Social cues and Cognitive Load Theory

Since this study examined the effectiveness of MM learning materials and since this effectiveness is associated here with cognitive load created during learning, the current section will show how according to ***Social Agency Theory***, social cues affect cognitive load and hence affect the effectiveness of the materials.

According to CLT, learning is dependent on the learner's cognitive load, since when there is overload learning is hindered. The aim in the design of MM learning materials is mainly to reduce the extraneous load and thus, free WM resources (Sweller, 1988; Cooper, 1990; Chandler and Sweller, 1991). When learners are engaged in activities that do not contribute to an understanding of content, inefficient use is made of WM resources and as a result little WM is left for germane processes for the creation of new cognitive schemas structures.

According to ***Social Agency Theory***, social cues from MM courseware that allow the learners to feel cultural interaction with the computer also cause them to automatically activate the social schema stored in the LTM. When the social schema is not automatically activated the extraneous load increases resulting in less efficient learning (Mayer, Sobko and Mautone, 2003).

In relation to this study, if the research assumption was right and students get more social cues while interacting with MM learning material with a familiar narrator, then, these NVSCs will initiate more efficient learning than NVSCs with unfamiliar narrator.

3.5 The role of voice

3.5.1 The role of voice as a social agent

Since the main focus of this study was finding out the influence of a familiar narrator on the learning efficiency, there was a need to examine the role of voice as a social agent.

Speech is one of the fundamental attributes of interpersonal communication, but it is much more than the simple transfer of words from the speaker to the listener. Speech also contains social messages that are beyond the words themselves. Since social rules in positive interaction between people, assume that the interlocutor is trying his/her best to make sense by being informative, accurate, concise and relevant, it obliges his/her partner, according to the *Co-operation Principle,* to respond accordingly by automatically activating a social interaction schema, which is also part of the biologically primary knowledge and to make a greater effort to understand what is being said (Grice, 1975; Mayer, Sobko and Mautone, 2003; Mayer, 2005a; Geary, 2007). In other words, social cues may affect the amount of WM resources the student will allocate to germane processing. Human beings react affectively to non-verbal communication such as speech tone, accent and dialect and also to paralinguistic messages such as, gender, gestures and facial expressions, eye contact and body language accompanying the voice (Watzlawick, Bavelas and Jackson, 1967; Ekman and Friesen, 2003; Navarro and Karlins, 2008). For example, people catalogue a voice as that of a woman, based on its high-pitched quality and rhythm. The gender attributed to voice affects the attitude and interpretation given to what is said and different voices can trigger different responses in the human brain regardless of the words.

Extensive studies relating to voice interfaces were conducted by Nass and Brave (2005), demonstrating the psychological and social aspects of voice interfaces and how they affect users' engagement with the technology. They found that people can behave politely towards computers, refer to and judge them according to gender stereotypes depending on the voice of the speaker. As an example, Nass and Brave (2005) found that in an e-commerce situation, people were more willing to purchase a product when the voice's gender matched the product's 'gender', e.g. women perfume *versus* after-shave lotion, whether the intended buyer was male or female. However, when the product was not 'gendered', a male voice was perceived as more credible. In a similar study, Whipple and

McManamon (2002) found that a female voice worked better for female gender products when the intended buyer was female and a male voice worked better when the intended buyer was male, even when the product was female gendered, which might indicate a *gender similarity attraction effect* (see section 3.6). Moreover, Dahlbäck, et al. (2007) found that listening to tourist information on a website, not only that people preferred an accent similar to their own rather than one suggesting familiarity with the destination, but the same accent speakers were perceived as being more knowledgeable than the local accented narrator whose expertise might have been higher.

In relation to learning material with voice interface, in an experiment, which was conducted with students, researchers used MM software featuring a man's voice on the one hand and a woman's voice on the other, in order to examine the effect of gender stereotypes on the students' responses to the narrator. It was found that the students related to the narrator with the same stereotypes as they did with their real teachers. It was shown, that praise from a male teacher was more highly regarded by the students than from a female teacher. Moreover, female teachers were regarded as better when they teach subjects that deal with love and relationships and were viewed much more critically when they teach technological subjects like computing (Nass and Brave, 2005).

Studies show that when interacting with computers, whether as learning tools, car navigating systems, answering machines, voice mail or narration on the web, people like voices that sound like their own, in terms of accent, or match their gender and personality (Nass and Brave, 2005; Nass and Yen, 2010). The authors also found that there is significance to the voice perceived emotion, e.g. happy, sad or neutral and importance is attributed to the consistency between the content being narrated and the perceived emotion of the voice. Indeed, experts claim that language developed more for the transfer of social messages than information (Nass and Brave, 2005).

Naturally, voice and words are interconnected in the transfer of social cues; different messages are stated in different tones of voice (Nass and Lee, 2001) and as a result of human development and as part of the primary knowledge, people are natural experts in the reception of social cues from the voices they hear (Holtgraves, 2008). People who have the ability to receive and understand social cues transferred by others can utilise opportunities to advantage much better than those who must make an effort to catalogue others and use this judgment in order to know how to relate to the other person (Goleman, 1995).

A person's brain is constantly engaged in the reception of social information from speech and this information affects his/her attitude and behaviour. Thus, developers of software combining voice and learning materials must ensure that the voice that is integrated into the software, whether computerised or human is such that it will evoke affection, trust or learning, depending on the purpose of the software (Nass and Steuer, 1993; Nass, Foehr and Somoza, 2000; Nass, Moon and Carney, 2006).

Research had shown that voice is of the greatest importance in intensifying learning processes in MM courseware (Link, et al., 2001; Moreno, et al., 2001; Atkinson, 2002; Moreno and Mayer, 2002; Mayer, Sobko and Mautone, 2003; Atkinson, Mayer and Merrill, 2005). It was also found that voice plays a more important role than APA (see section 3.4.1) in contributing to academic achievement (Craig, Gholson and Driscoll, 2002) and that in fact, voice itself constitutes a sufficient social cue (Louwerse, et al., 2005).

Mayer, Sobko and Mautone (2003) studied the connection between the voice of the speaker – whether socially appealing or otherwise – and the attitude of the learner to the speaker as social agent. In studies which implemented MM tutorials given to psychology students, related to the formation of lightning, they found that students who received educational instructions from a speaker with a standard accent achieved better results in transfer tests in which they were asked to solve new problems *versus* students who received the same instructions, but in a foreign accent. Furthermore, participants who listened to a speaker with a standard accent graded the speaker more favourably than participants who listened to a speaker with a foreign accent. In other experiments the same effect was found with a speaker with a human voice *vis-à-vis* one with a computerised voice, where students had more positive perception of the human voice and their performance on subsequent tasks was better (Mayer, Sobko and Mautone, 2003; Mayer, 2005a; Stern, Mullenix and Yaroslavsky, 2006; Mayer, 2011a; Mayer and DaPra, 2012). Moreover, in another research conducted by Graesser, et al. (2003), it was found that when the voice of the speaker was a computerised one there was no advantage to the narration *vis-à-vis* written text –i.e. the *Modality Effect* (Mousavi, Low and Sweller, 1995; Mayer, Sobko and Mautone, 2003; Atkinson, Mayer and Merrill, 2005; Mayer, 2005a) was lost when the voice was not human, reinforcing the claim that the human voice has an advantage over a computerised voice in terms of its effect on learning.

These studies support the conclusion that a human voice with an accent familiar to the learner plays a role in the transfer of social messages in a MM study environment, alleviating extraneous cognitive load and thus, encouraging learning processes and their results. However, it should be noted that these findings were criticised because the experiments were conducted under artificial laboratory conditions with subject matter irrelevant to the students and that MM learning material was short, i.e. lasting approximately two minutes (Atkinson and Merill, 2004). Thus, in subsequent studies, Atkinson, Mayer and Merrill (2005) replicated the human *versus* synthesised voice studies in a realistic classroom with longer, more typical lesson (40 min.) with high school students, as well as a laboratory setting with college students, teaching procedural knowledge, rather than conceptual knowledge, as in the previous studies, with authentic educational context and unlimited time for task performance. Their results supported the previous *voice effect* findings, in both the natural learning setting and the laboratory setting.

Voice may also be distinguished by the type of the narration; the narrator being polite to the users as found in the *Politeness Effect* (Nass and reeves, 1996; Nass and Brave, 2005) and by the speech style of the narrator – formal, i.e. using third person and no comments directed at the learner or conversational, i.e. using first person and/or comments directed at the learner, according to Mayer's *Personalisation Principle* (Mayer, 2005a). According to ***Social Agency Theory*** (Mayer, Sobko and Mautone, 2003), with polite narration and/or a conversational one, learners interpret the MM learning as a case of social interaction.

Since it was found that human narration with a familiar accent, as opposed to a computerised one, has a major effect on human social interaction with the computer and that an APA is not always important in MM software (Fothergill, 2008; Mayer, 2011a), it may be stated, that all MM courseware that incorporate local accent human narration, with or without APA, provide the learner with social cues and the more social cues the software is able to elicit the more pronounced the effect on the learner's understanding is (Mayer, 2005a).

In summation, in relation to the narration aspects of MM learning it was found that a human voice is superior to a computerised one. Moreover, the politeness of the speaker, the language being formal or conversational and the type of accent, i.e. local or foreign all affect the amount of social cues the learner receives and the more social cues received the greater the effort will be to learn (Mayer, 2005a; Wang, et al., 2008; Mayer, 2011a) .

In this study, all the narrators in the NVSCs had local accent and narration was conversational and it was assumed that the familiarity with the narrator will have the same impact, as described above, on the learners in terms of their perceived effectiveness of the NVSC and also in actual terms manifested in learning process efficiency, efficiency in performing a task and motivation to perform it. The assumption went on to state that when the narrator is a teacher known to the students they receive social cues beyond those they would normally obtain from the voice of an unfamiliar teacher thus making the learning experience a more positive interaction.

3.5.2 Voice familiarity

Humans are very sensitive to voice characteristics and very easily distinguish one voice from another (Stevens, 2004). Even a fetus in the womb can already distinguish his mother's voice and right after birth babies are able to distinguish between different voices (Floccia, Nazzi and Bertoncini, 2000). Moreover, a familiar voice is processed differently from an unfamiliar voice in the human brain and includes face image and voice (van Lancker and Kreiman 1987; van Lancker, et al., 1988; van Lancker, Kreiman and Cummings, 1989; Campanella and Belin, 2007). Thus, recognising people is a multimodal and multifaceted process (von Kriegstein, Kleinschmidt and Giraud, 2006). Voice and face processing are not strictly separated but interact and recognition of a voice is facilitated by previous exposure to the corresponding face and *vice versa* (Ellis, et al., 1997). Thus, the assumption in the present research is that on hearing the class instructor's familiar voice in the NVSC, the students' interaction with the computer will be more positive, since the students have a mental image of the class teacher, including other social cues, e.g. body language and face expressions (von Kriegstein, Kleinschmidt and Giraud, 2006; Campanella and Belin, 2007).

According to Nass and Brave (2005), it is sometimes important that the same voice be used in all parts of a software for consistency. Extensive study has been done regarding voice familiarity in the context of speech intelligibility and phonetic identification. Some of the studies were conducted from the perspective of the effects of voice variability and others from the perspective of familiar *versus* unfamiliar voices. These studies show that consistency and familiarity of voice affect word recognition. From the perspective of voice variability, in a study conducted by Mullennix and Pisoni (1990), a set of words was read and it was shown that when participants were asked to recognise words that were read to them, reaction time was longer when two voices were used than when one voice, either of a female or male. These researchers also found that increasing the number of voices resulted in further lengthening the recognition time. Additionally, words narrated by multiple voices led to a decrease in accuracy compared to a single voice narration. In a follow-up study, Nygaard and Pisoni (1998) found the same influence of voice variability with sentences. In a previous study, Goldinger (1996) showed that listeners exhibit a same-voice advantage in recall linguistic task. Moreover, with a delay of time the ability of the listeners to remember the voice declined, but they were still able to recall the words better than with different voices. From the perspective of voice familiarity, studies show that recognition memory for a word is improved when it is presented in the same voice as it had been originally (Sheffert and Fowler, 1995; Church and Schacter, 1994)

Studies with voice familiarity found more accurate speech recognition for a trained voice than for a novel voice (Nygaard and Pisoni, 1998; Nygaard, Sommers and Pisoni, 1994). In these studies, a group of undergraduates was trained to associate 10 voices with different names. Those participants who succeeded at this, later showed better speech identification, with noise background, when the speech was from these known speakers, suggesting that stored information about a voice was helpful. Magnuson, Yamada and Nusbaum (1994a; b; 1995) used participants' family relatives as speakers, and found that listeners were faster and more accurate at identifying speech in a well-known voice, especially when the speech was presented with a noise background. However, frequent alternation among a set of speakers was as disruptive to listeners when all of the voices were well-known as when the voices were all unfamiliar, suggesting that there is a difference between voice familiarity and voice variability.

Most models of voice effects assume that a familiar voice will activate voice-specific information, making the task of identifying the linguistic message easier. This is presumed to occur automatically, suggesting that it is the familiarity with speaker's type of speech rather than a conscious identification of the speaker. Indeed, Craik and Kirsner (1974) have argued that effects of speaker variability are based entirely on physical aspects of the stimuli, and that identity of a speaker does not simply serve as a retrieval cue.

In most of the studies, familiarity was introduced having the participants hearing a voice on a number of previous words in the same experiment. This is likely to be different from the degree of familiarity that comes from interacting with a person frequently, as demonstrated by Magnuson, Yamada and Nusbaum (1994a; b; 1995). These different levels of familiarity are generally not well distinguished in the literature, and most work has used relatively unfamiliar speakers.

In a study conducted by Newman and Evers (2007), different forms of familiarity with a speaker were contrasted, to better explore how these types of familiarity might influence a listener's ability to understand that voice in the context of noise. Listeners were asked to shadow a target voice, which was introduced to them before, while a second voice spoke fluently in the background. Listeners differed in their familiarity with the target voice: one group was familiar with the voice and were told explicitly whose voice they would be hearing; a second group was familiar with the target voice but were not warned whose voice it was and members of a third group were entirely unfamiliar with the target voice. It was found that the listeners who had an explicit knowledge of the speaker's identity made significantly fewer shadowing errors than those with only implicit familiarity. Familiarity did influence the types of errors listeners made: those participants who were familiar with the target voice prior to the test session made fewer incorrect responses than did those who had not heard the speaker previously. In a second experiment, neither explicit knowledge of a distracter voice's identity nor implicit familiarity with the background speaker had any effect on shadowing a target voice. This suggests that familiarity with a voice only helps listeners when that voice is the one being attended.

In an attempt to distinguish between explicit and implicit knowledge with participants of different ages, Yonan and Sommers (2000) found that elderly listeners were less accurate at recognising the speaker's voice, but showed the same and sometimes even a greater benefit of voice familiarity in word recognition as did younger listeners.

In another study, Levi, Winters and Pisoni (2011), examined how familiarity affects intelligibility by manipulating the type of speaker information available to listeners. One group of listeners learned to identify bilingual speakers' voices from English words. A second group of listeners got acquainted with the same speakers from German words. After voice training, both groups of listeners completed a word recognition task with English words produced by both familiar and unfamiliar speakers. Results revealed that English-trained listeners perceived more phonemes correctly for familiar than unfamiliar speakers, while German-trained listeners did not show improved intelligibility for familiar speakers. According to the researchers, the absence of a processing advantage in speech intelligibility for the German-trained listeners demonstrates limitations on the advantage of a familiar speaker, which crucially depends on the language context in which the speakers' voices were introduced; knowledge of how a speaker produces linguistically relevant contrasts in a particular language is necessary to increase speech intelligibility for words produced by familiar speakers. These findings are in line with Craik and Kirsner (1974), who claimed that the identity of the narrator does not serve as a retrieval cue.

However, according to Lee and Nass (2004), sometimes various voices are better, like when listening to different criticisms of a book or several evaluations of a product, since people are wired to hear different opinions coming from different people. Therefore, an individual is more convinced by an opinion when different opinions are expressed by a variety of voices than when expressed by a single voice, even if the different opinions could have been narrated by the same voice.

Research in advertising shows that consistency of the voice is less important when listeners are familiar with the speakers. Thus, if advertisers use celebrities' voices or voices familiar as the result of repetition, then it may be possible to use varied voices in an advertisement (Levi and Pisoni, 2005).

No research was found that investigated the influence of voice familiarity on students' learning efficiency, in the context of MM learning, from cognitive load perspective. The present research refers to familiarity with the speaker as the acquaintance and personal relationship students have with their class teacher through face to face lessons. Reference to voice interface, in the study, is from the perspective of cognitive load in the context of the instructional design of MM learning material and focuses on social cues that can be received through voice and the influence on learning efficiency and motivation on task.

3.6 The principle of similarity attraction

The following section discusses the *Principle of Similarity Attraction*, which suggests another source for social cues during learning.

The *Principle of Similarity Attraction* suggests that individuals tend to be attracted and react more positively to those similar to themselves (Byrne and Neuman, 1992; Graves and Powell, 1995; Bandura, 1997).

In accordance with the *Principle of Similarity Attraction*, research has found that people prefer to interact with others having the same accent and personality traits as themselves and since people classify personality according to voice, voices in computer programs assume a personality trait (Nass and Brave, 2005; Nass and Yen, 2010). Most of the research done on voice from the personality perspective, related to extroversion/introversion traits: i.e. a fast speech rate, loud volume level, high pitch and wide pitch range is attributed to an extroverted personality while the opposite is attributed to an introverted personality. People identify subconsciously the personality in the voice and in accordance with the *Principle of Similarity Attraction* will respond more positively to a voice with a personality which matches their own and this determination has a strong effect on people's attitudes, feelings and intentions (Nass and Brave, 2005; Nass and Yen, 2010).

3.6.1 Gender similarity effect

Several researchers tried to differentiate the effect of gender similarity. These studies produced mixed results concerning the impact of this effect. In the field of employee recruitment, for instance, the study by Graves and Powell (1988) reported no significant effect of applicant gender on interview outcome, but the perceived similarity and interpersonal attraction were important factors in recruiters' decision processes. In a study in the credit market, Beck, Behr and Madestam (2012) found that borrowers matched to officers of the opposite sex were less likely to return for a second loan. In another study, Graves and Powell (1995) found the *Opposite Attraction Effect* where female recruiters perceived male applicants as more similar to themselves and more qualified than female applicants. Yet, Hardin, Reding and Stocks (2002) and Behrend and Thompson (2011) found that the gender similarity did not have significant influence. Lee, Liao and Ryu (2007) found mixed findings when listening to a synthesised voice, males rated a male's voice higher than a female voice, whereas no difference in voice likeability was found for female participants.

Other studies, in the field of sales person-customer relationship suggested that gender similarity between sales persons and customers is positively related to the quality of their relationship and sales outcome (Smith, 1998). Crosby, Evans and Cowles (1990) and Churchill, Ford and Walker (1997) found that same-gender relationships are associated with more relationship investment and greater trust and satisfaction. However, a study by Dwyer, Orlando and Shepherd (1998) found that gender similarity was not a significant factor in sales performance, while Jones, et al. (1998) found the *Opposite Attraction Effect,* where customers were more accepting of salespersons that were of the opposite gender.

In the context of speech, research has found that when the gender of the narrator in a computer program, even in one that uses a computerised voice, is the same as that of the user, people respond with social identification, particularly if the voice is one that arouses trust (Nass and Brave, 2005). On the other hand, other studies have found that students, regardless of their gender, prefer a woman's voice. Still others have found that there is an advantage to the voice of a man, regardless of the student's gender (Nass and Brave, 2005), which implies that there might be a bias related to the subject matter.

In this study, the personality aspect of the similarity attraction was not taken into consideration because the NVSCs included narration of a learning material, that is, it was difficult to perceive the actual personality of the narrators, since that was not their natural way of talking. It was more a didactic explanatory intonation, on purpose. However, the narrator's gender was an obvious characteristic attribution, since people automatically judge a narrator's gender according to the voice pitch. Thus, using local accent narration with the NVSCs, it was more appropriate to investigate whether gender similarity can affect learning efficiency. It should be emphasised that in the present research only the gender similarity variable was of interest, gender by itself was not used as an independent variable and it was controlled during the statistical analyses (see section 4.4.1.2).

Following the assumption that an interaction with a familiar person elicits more social cues than with an unfamiliar person and thus, decrease extraneous cognitive load, the research assumption was, that listening to MM courseware, featuring narration by a narrator who is unfamiliar to the student will arouse less social cues, thus, preventing students from activating the social schema and causing them to be engaged in unnecessary cognitive activities.

The NVSC itself did not provide any visual social cues, since no human image appeared on the screen; all social cues were auditory in nature and reached either directly via the voice or indirectly, through a mental image formed as a result of interacting with a NVSC with the voice of the familiar teacher. From this it was hypothesised that NVSC featuring the voice of a familiar teacher will cause less cognitive load. Also examined was the *Similarity Attraction Effect*; the interaction between voice familiarity and student-narrator's gender similarity (Nass and Lee, 2001; Nass and Brave, 2005). The assumption being, that since with an unfamiliar voice students receive less social cues, they would get some compensation for that through a narrator of the same gender as theirs.

In conclusion, based on ***Social Agency Theory*** (Mayer, 2005b), students receive social cues from MM learning materials that feature a human voice. Social cues affect students' cognitive load, thus, influencing the efficiency of student learning. The research aimed to reveal whether there is any influence to the familiarity of students with the narrator. The research also sought an answer to the question of whether there is a difference in both the perceived and actual effectiveness of the learning materials and whether student-narrator gender similarity has any influence in the matter. This research also aimed to fill the methodological gap by conducting research in a realistic learning setting with learning material relevant to students.

Following are the hypotheses that stem from the cognitive theories reviewed and in particular, ***Social Agency Theory***. The assumption underlying the following hypotheses is that a familiar narrator elicits more positive social interaction with more social cues and thus, helps in reducing extraneous cognitive load and increasing motivation to learn.

3.7. Hypotheses related to voice familiarity

Hypothesis 1.

The learning and performance efficiency indices of the students who heard a familiar voice will be higher than the learning and performance efficiency indices of students who heard an unfamiliar voice.

1.1 The efficiency of the learning process (LPE) of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice.

1.2 The efficiency of task performance (TE) of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice.

1.3 The Three-dimensional learning efficiency (3D-E) of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice.

Hypothesis 2.

The degree of motivation for performing a task (MT) in the case of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice.

Hypothesis 3.

The assessment score of the narrated video screen captures (NVSC-A) of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice.

Following are the hypotheses that stem from the CLT, ***Social Agency Theory*** and the *Similarity Attraction Principle*. The assumption underlying the following hypotheses is that narrator-student gender similarity with an unfamiliar narrator elicits more social cues than when the unfamiliar narrator is of the opposite gender. Thus, extraneous load is reduced and learning is enhanced.

3.8 Hypotheses related to gender similarity and voice familiarity

Hypothesis 4.

The learning and performance efficiency indices of students who heard an unfamiliar voice belonging to a gender identical to theirs will be higher than the learning and performance efficiency indices of students who heard an unfamiliar voice belonging to a different gender. There will be no influence of gender similarity when the voice of the narrator is familiar.

4.1 When the voice is unfamiliar, the efficiency of the learning process (LPE) of students who heard a voice belonging to a gender that is identical to theirs will be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the level of efficiency of the learning process (LPE) of students who heard a voice belonging to a gender identical to theirs *vis-à-vis* students who heard a voice belonging to a different gender.

4.2 When the voice is unfamiliar, the task performance efficiency (TE) of students who heard a voice belonging to a gender identical to theirs will be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the level of task performance efficiency (TE) of students who heard a voice belonging to a gender identical to theirs *vis-à-vis* students who heard a voice belonging to a different gender.

4.3 When the voice is unfamiliar, the Three-dimensional learning efficiency (3D-E) of students who heard a voice belonging to a gender identical to theirs will be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the 3D efficiency of students who heard a voice belonging to a gender identical to theirs *vis-à-vis* students who heard a voice belonging to a different gender.

Hypothesis 5.

When the voice is unfamiliar, the degree of motivation for task performance (MT) of students who heard a voice belonging to an identical gender will be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the degree of motivation for task performance (MT) with students who heard a voice belonging to identical gender *vis-à-vis* students who heard a voice belonging to a different gender.

Hypothesis 6.

When the voice is unfamiliar, the assessment score of the NVSC (NVSC-A) of students who heard a voice belonging to an identical gender will be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the assessment score of the NVSC of students who heard a voice belonging to identical gender *vis-à-vis* students who heard a voice belonging to a different gender.

The previous sections of this chapter reviewed theories based on cognitive load perspective. Two sets of research hypotheses were framed in the light of the relationship between NVSCs, ***Cognitive Load Theory***, ***Cognitive Theory of Multimedia Learning, Social Agency Theory and*** *gender similarity effect.* The next section will discuss individual differences between students and introduce two additional sets of hypotheses in light of the ***Cognitive-Affective Theory of Learning with Media***.

3.9 Individual differences

The previous section described cognitive theories relating to learning through MM study materials. The present section presents a literature review of individual differences between students that might affect their academic achievement. According to CATLM, cognitive processes are dependent on individual affective differences as well (Moreno, 2005). The most conspicuous characteristics in this domain are personality and motivational aspects. The former relates to personality traits and the first part of the present section discusses various aspects linking personality and learning, while focusing in particular on **conscientiousness**, which was found to be more directly and consistently positively related to motivation and academic achievement than other characteristics. The second part of this section focuses on motivational variables and the relationship between them and academic achievements. This part dwells in particular on **test-anxiety**, an affective motivational variable that has a proven connection with cognitive load and the only motivational variable that has a negative correlation with academic achievement.

Educational psychologists have long sought to understand the reasons for differences between students in all matters relating to academic achievement. Even though cognitive capabilities are the most natural choice for predicting academic success, many studies have shown that personality and motivational variables also play a part in such prediction (Kyllonen, Walters and Kaufman, 2005). However, cognitive affective aspects were not taken into consideration in most cognitive load related studies of MM leaning. Thus, this is an added value of this research, especially in the present age when MM study material has found such widespread use and in the light of the insights into the affective implications of MM courseware on learners, as described in the sections on ***CTML***, ***Social Agency Theory*** and ***CATLM***.

Even though cognitive capabilities are an important component in predicting academic achievement (Ackerman and Heggestad, 1997), they were found to be insufficient in predicting differences in academic achievement between students (Chamorro-Premuzic and Furnham, 2006). Since this is the case, many researchers have sought other predictors that are not cognitive, among them the personality and motivational variables of the students. It was hypothesised that behavioural tendencies that reflect personality traits and motivation could influence academic success, since in fact, cognitive capabilities reflect the person's capabilities whereas personality traits reflect the person's practical performance, especially on the higher academic level (Goff and Ackerman, 1992; Rothstein, et al., 1994; Ackerman, et al., 2001; Furnham, Chamorro-Premuzic and McDougall 2003; Furnham and Chamorro-Premuzic, 2004). One explanation for the greater influence of personality traits as compared with cognitive capabilities in HE is the tendency in that domain to attach greater importance to behaviour that is associated with motivation and other personality variables than, say, to critical thinking (Ackerman, et al., 2001).

Students differ in their personality traits and in their motivation to study and a basis exists in research for the hypothesis that personality traits are related to motivation, as well as to academic achievement (Deci and Ryan, 1985; Elliot and McGregor, 1999; Matthews, Zeidner and Roberts, 2006). Numerous research studies have examined differences between students from the point of view of academic achievements but few have related to the affective aspects of study. An appreciation of these differences between students can serve as a basis for understanding their different approaches to study and for adapting learning materials so that students will be able to derive the maximum benefit from them.

This research examined the possible influence of familiarity with the narrator on the student's perception of the material's effectiveness, the efficiency of learning and the motivation of the students to study from these learning materials. The research also examined the possible interaction between **conscientiousness** and **test-anxiety** on the one hand and a familiar or unfamiliar narrator on the other and its influence on learning through MM study materials. An understanding of the connection between personal characteristics and affective variables on academic performance can help in designing more effective learning materials and teaching methods. Indeed, a number of research studies have emphasised the importance of adapting the learning environment to individual differences between students (Furnham, 1992; de Raad and Shouwenburg, 1996; Riding and Wigley, 1997; Vermetten, Lodewijks and Vermunt, 2001; Zhang, 2002; 2003).

The research was based principally on cognitive theories as described in the previous sections, with **conscientiousness** and **test-anxiety** being intended to provide an additional perspective on the impact of individual differences on learning indices under different conditions.

3.9.1 Conscientiousness

A number of research studies have been conducted during the past three decades in an attempt to identify generic characteristics that typify a person and contribute to an understanding of his/her personality (Block, 1961; Costa and McCrae, 1992a; 1992b; Caprara, Barbaranelli and Zimbardo, 1996; Caspi, Roberts and Shiner, 2005; Cucina and Vasilopoulos, 2005; Chamorro-Premuzic, 2007). These researchers have identified five key dimensions that explain the chief differences between individuals, referred to as the ***Big Five Model*** or the ***Five Factor Model*** (FFM) (Costa and McCrae, 1992a; 1992b; Cattell, 1996). The model represents a theory that describes personality in the framework of five basic characteristics: extraversion, neuroticism, openness to experience, agreeableness and **conscientiousness**.

The ***Big Five Model*** has aroused great interest among researchers and it constitutes a foremost model in contemporary literature for understanding the personality structure (O'Connor and Paunonen, 2007).

Research studies have shown that the ***Big Five*** characteristics reflect central aspects in personality traits and have a considerable and consistent impact on affective, cognitive and behavioural patterns (Costa and McCrae, 1992a; Furnham, 1992; Jackson and Lawty-Jones, 1996; Duff, et al., 2004; Furnham, 2008).

Following is a brief description of the characteristics of each of the five personality traits according to the model and their relation to academic achievement:

Openness to experience

This trait contains sub-traits such as wide range of interests, openness to experimentation, imagination, curiosity, originality, artistic sensitivity and intellectual interest. This dimension has been the source of controversy among researchers. Whereas some researchers have labelled it culture (Norman, 1963), others have suggested calling it intellect (John, Donahue and Kentle, 1991). Recently, in the wake of research by Costa and McCrae (1992a), a consensus has been established around the understanding that this dimension includes characteristics such as imagination, curiosity, originality, artistic proclivity and broadening of horizons and is referred to as 'openness to experience'.

In regards to academic achievement, mixed findings have been obtained in this realm. On the one hand, a number of studies have identified a positive correlation between openness to experience and academic achievement (Dollinger and Orf, 1991; Rothstein, et al., 1994; Gray and Watson, 2002; Lievens, et al., 2002; Farsides and Woodfield, 2003; Lounsbury, et al., 2003; Phillips, Abraham and Bond, 2003; Chamorro-Premuzic and Furnham, 2009; Poropat, 2009). On the other hand, others found no connection between them (de Fruyt and Mervielde, 1996; Paunonen and Ashton, 2001; Chamorro-Premuzic and Furnham, 2003b). The explanation for the connection is that openness indices have always been found to be positively correlated with intellectual curiosity, cognitive capability and intelligence (Chamorro-Premuzic and Furnham, 2005; Furnham, et al., 2007).

Neuroticism

This characteristic represents differences between individuals as regards their tendency to experience tension, fear, depression, anger, emotionalism, lack of confidence, nervousness and fearfulness. Individuals ranking low on the scale are typified by emotional stability and ability to cope with states of tension, fear and anxiety (Chamorro-Premuzic and Furnham, 2009).

Some studies have found a negative correlation between neuroticism and academic achievement (de Fruyt and Mervielde, 1996; Chamorro-Premuzic and Furnham, 2003a;

2003b), but this correlation has not been found to be sufficiently strong to explain the impact on academic achievement (O'Connor and Paunonen, 2007).

The explanation for the connection is that students who are more mentally stable show better academic performance because of the absence of inhibiting factors such as fear and mental instability (Chamorro-Premuzic, et al., 2005). Moreover, research has found that neuroticism is related to surface learning, i.e. the surface motive being to meet requirements minimally. Surface strategy is to limit the target to bare essentials and reproduce them through rote learning (Chamorro-Premuzic and Furnham, 2009).

Extraversion/Introversion

Extraversion is composed of sub-traits such as sociability, talkativeness, assertiveness, adventurism, daring, activeness and energy. This is in contrast to individuals ranked at the other end of the scale, namely, introverts, described as shy, quiet, inhibited and closed (Chamorro-Premuzic, 2007).

In regards to academic achievement, here too contradictory findings have been obtained. Some studies have found no connection between extraversion and academic achievement while others have found a positive connection between the two (Rothstein, et al., 1994). Extraversion is predicted to score high on the deep learning approach (Chamorro-Premuzic and Furnham, 2009). The deep learning approach is characterised by an intrinsic interest in what is being learned, in order to develop competence in particular academic subjects. Previous research found that achievement motivation was positively correlated with extraversion (Heaven, 1989). On the other hand, some researchers have found a negative correlation between extraversion and academic achievement (Goff and Ackerman, 1992; Busato, et al., 2000; Bauer and Liang, 2003; Furnham, Chamorro-Premuzic and McDougall, 2003; Furnham and Chamorro-Premuzic, 2004; Hair and Hampson, 2006).

Agreeableness

This trait includes sub-traits such as politeness, easygoing interpersonal relations, flexibility, a trusting disposition, co-operation, forgiveness, consideration and tolerance. Lying at the other end of the scale are hostility, apathy and lack of concern for others. The most widespread consensus between researchers is seen in their attitude to this dimension (Chamorro-Premuzic, 2007).

The findings of research related to academic achievement and agreeableness are not consistent. According to some research, agreeable individuals tend to be trusting, sympathetic and co-operative (de Raad and Shouwenburg, 1996; Komarraju and Karau, 2005). Agreeableness was also found to be positively correlated with perseverance, grades orientation and a desire for self-improvement (Komarraju and Karau, 2005). On the other hand, certain studies have found agreeableness to be unrelated to academic achievement on the level of HE (O'Connor and Paunonen, 2007).

Conscientiousness

This trait is defined by sub-traits such as: responsibility, reliability, diligence, readiness to adapt to new rules, efficiency, organisation, planning and achievement aspirations (Roberts, et al., 2005). In a review performed by Barrick and Mount (1993) they demonstrated that **conscientiousness** refers to a person who can be relied upon, who is careful, responsible, organised and efficient, who plans and who is achievement conscious and competitive. According to McCrae and Costa (1997), this dimension is the most moral of all. Conscientious people are described as having high internal motivation (Furnham and Medhurst, 1995), as being persevering and reliable, with self-discipline and an ability to cope with difficulties (Costa and McCrae, 1985). Highly conscientious people always aspire to achieve the best results by proper organisation of their time and study environment (Diseth, 2003).

3.9.1.1 Conscientiousness and academic achievement

Conscientiousness has been found to be the most consistent predictor of academic success (Busato, et al., 2000; Gray and Watson, 2002; Chamorro-Premuzic and Furnham, 2003a). As stated earlier, extraversion, agreeableness, neuroticism and openness to experience were found not to be consistent predictors with respect to all aspects of academic achievement (Paunonen, 1998; Farsides and Woodfield, 2003).

However, a few research studies have found that even **conscientiousness** is not a predictor of academic achievement (Cheng and Ickes, 2009), but with respect to these researches the possibility was raised that this could be accounted for by interaction with other variables in the research, with the different variables offsetting each other. For example, students with low **conscientiousness** at times enjoy high academic achievements if they possess other compensatory characteristics, e.g. high motivation. Such interaction occurs when a high ranking in one variable compensates for a low ranking in the other (Ryan, et al., 1984; Linnenbrink and Pintrich, 2002).

de Raad and Schouwenburg (1996, p. 325), argued that **conscientiousness** is the '…main psychological resource in learning and education'. A research conducted by Kyllonen, Walters and Kaufman (2005) on a first-year population of adult students found that personality predictors provided a better explanation for differences in academic performance than indices of cognitive capabilities, with the prime manifestation being the effect of **conscientiousness**. This finding was supported with a later finding from research conducted by Robbins, et al. (2006) and a meta-analysis conducted by O'Connor and Paunonen (2007), which showed that **conscientiousness** in particular, is associated with academic success.

Since of all the Big Five, **conscientiousness** was found to be most strongly and consistently associated with academic achievement, this research focused on an examination of the impact of this trait on the efficiency of learning under the different conditions in the study. As the research hypotheses state, that there might be a negative effect on learning when listening to a narrator who is unfamiliar to the students, the question arose as to whether in the case of an unfamiliar voice, there would be a greater difference in the efficiency of learning between students with high **conscientiousness** and those with low **conscientiousness** in comparison to the case of a familiar voice. The hypothesis was that a familiar voice facilitates learning; thus, the difference in learning indices between students with high **conscientiousness** and those with low **conscientiousness** would be smaller than in the case of a non-familiar voice, where learning condition is assumed to be less favourable to the students. Thus, students that are more conscientious might be more willing to cope with it.

3.9.2 Test-anxiety

Following the review of individual differences between people from the personality traits perspective, this section will clarify motivational variables as predictors of academic achievement while highlighting the connection between them and **conscientiousness** and a rationale will be given for choosing **test-anxiety** to be the most appropriate variable to be included in the research.

One of the factors in individual differences is motivational traits. Many psychologists and educators have, from the outset, treated motivation as an important factor in learning (Ames, 1992). Researchers have shown that motivation can also predict the quality of involvement in learning (van Merriënboer and Kürschner, 2001), as well as the degree of perseverance in difficult situations (Ames, 1992; Pintrich, 2000b).

The concept of motivation can be researched from different perspectives, but one of the fields in which an investigation of motivation is very relevant is that of learning.

A particularly high emphasis has been placed in recent years on achievement goals (Linnenbrink and Pintrich, 2002). Achievement goals relate to the reasons that motivate the student and how this motivation changes according to the subject being studied and the study environment (Urdan and Maehr, 1995). ***Achievement Goal Theory*** claims that the achievement goals of students offer the best explanation for their learning, behaviour and motivation for study (Nicholls, 1984; Dweck, 1986; Ames, 1992; Wigfield and Cambria, 2010).

The literature refers to two principal goal orientation models: mastery goal orientation and performance goal orientation (Nicholls, 1984). However, various researchers have defined these goals by different names:

- Task involvement goal orientation *versus* ego-involvement goal orientation (Dweck, 1986);
- Learning goal orientation *versus* performance goal orientation (Pintrich, et al., 1991);

Extrinsic goal orientation *versus* intrinsic goal orientation (Zusho, Pintrich and Cortina, 2005; Payne, Youngcourt and Beaubien, 2007);

Nevertheless, meta-analysis conducted recently found that a weak positive correlation exists between goal orientation and academic achievement (Baker, 2004; Kyllonen, Walters and Kaufman, 2005). Thus, the question of the prediction capability of goal orientation with respect to academic achievement is still a controversial one (Church, Elliot and Gable, 2001; Murayama and Elliot, 2009) and it appears to depend on the context in which these goals are manifested (Steinmayr, Bipp and Spinath, 2011). In any event, the conclusion according to the researches is that although goal orientation is a clear predictor, it is not very a strong one with respect to academic achievement (Payne, Youngcourt and Beaubien, 2007). In order to assess the effect of goal orientation on academic achievement, consideration must also be given to other factors such as intelligence and personality variables and this has virtually not been done (Elliot and Thrash, 2002; Bipp, Steinmayr and Spinath, 2008).

Personality traits and goal orientation have been found to be frequently related (Murayama and Elliot, 2009) and in fact goal orientation can be regarded as part of an individual's personality makeup, while on the other hand it is principally influenced by the context and variables in the study environment with the connection between it and the latter not yet established in research (Pintrich, et al., 1991; Pintrich and Schrauben, 1992a; Pintrich and Schrauben, 1992b; Pintrich, 2000a; 2000b; Pintrich and Schunk, 2001; Pintrich, 2003; Pintrich, Conley and Kempler, 2003). Thus, research efforts are still being made to continue examining the relationship between them and their effect on academic achievement (Steinmayr, Bipp and Spinath, 2011).

Pintrich, et al. (1991; 1993) divided motivational variables into six categories. Three variables were defined as value components, two as expectancy components and one as an affective component ~ test-anxiety.

The Three Value Components of Motivation:

- ***Intrinsic goal orientation*** refers to the degree to which the students view themselves as engaging in studies for reasons of challenge, curiosity and command of the study matter. In such a case, engagement in the study task is a goal in itself and not just a means to achieve a certain end;
- ***Extrinsic goal orientation*** complements intrinsic goal orientation and refers to the degree to which the students perceive their engagement in study tasks as a means to earning good grades, awards, praise and esteem by others or as a reason for competing;

- ***Task value*** refers to the students' evaluation of the importance they attach to performing a task. A high value in the task value index should cause them greater involvement in study*;*

The Two Expectancy Components of Motivation:

- ***Control of learning beliefs*** refers to the belief on the part of the students that the positive results deriving from efforts they invest in study depend on them only and not on any external factor. The assumption is that if the students believe that the efforts they invest in study will bear fruit, they will study in a more effective manner and will use efficient learning strategies in order to achieve their end;
- ***Self-efficacy*** for learning and performance is an index that appraises the students' expectations of success and their own capabilities. Expectations of success refer to the level of performance of the task while self-efficacy is a self-evaluation on the part of the students regarding their abilities to perform the task and the degree of confidence they have in their ability to do so;

The Affective Component of Motivation:

- ***Test-anxiety*** is a personality makeup that affects the academic performance of a student. It is composed of a number of dimensions, including cognitive, affective, psychological and behavioural responses to situations that contain a dimension of evaluation. The cognitive component refers to negative thoughts students have that interfere with their performance whereas the affective component refers to emotional and physiological symptoms of anxiety (Spielberger, Gorsuch and Lushene, 1970);

Many theoreticians have distinguished between the *trait* of **test-anxiety** and the *state* of **test-anxiety**. The *trait* of **test-anxiety** is described as the consistent tendency on the part of a person to experience anxiety in different situations while the *state* of **test-anxiety** depends on the evaluative situation (Zohar and Brandt, 2002; Reeve and Bonaccio, 2008). The more the test that the person is to take determines his/her future, the greater is his/her anxiety (Reeve, Bonaccio and Charles, 2008). This is found to be the principal factor in causing anxiety during a test. An additional factor that is found to be the most influential in terms of the *state* of anxiety is the confidence that the students feel in themselves (Hembree, 1988; Sapp, Durand and Farrell, 1995). The application of the material taught via the NVSCs was given to the students in the form of tests and marks were given on their performance – having a weigh of 2% of their final course grade. Therefore, those exercises entailed a certain amount of test anxiety.

3.9.2.1 Test-anxiety and cognitive load

It is claimed that the negative effect of the state of anxiety on the intellectual performance is rooted in the WM. According to Eysenck and Eysenck (1985), anxiety lowers the working efficiency of both the WM and the LTM. Anxiety reduces attention selectivity and raises distractibility. In other words, people who are in a state of high anxiety are engaged in many more processes, which are unrelated to the task than people who are not in a state of anxiety. Eysenck and Eysenck's study (1985) supports other researches which found that the state of anxiety causes interfering cognitive processes during performance of the task and this is the principal factor affecting performance (Baumeister, 1984). This explanation is also in line with the explanation offered by Easterbrook (1959), who found that states that cause high anxiety and arousal reduce the range of cues that are available to the person in that state. Effective use of cues helps the students focus only on messages that would assist them in learning through the construction of suitable cognitive schemas. In students suffering from **test-anxiety**, the drop in performance is a result of the lack of ability to perform an effective learning process and to retrieve the information, which they had learned previously and which is needed during the test. In other words, a state of **test-anxiety** does not numb the students, robbing them of the ability to do anything, as claimed by (Naveh-Benjamin, 1991; Schwarzer and Jerusalem, 1992; Kane and Engle, 2000; Ashcraft and Kirk, 2001; Beilock and Carr, 2005), but rather causes them cognitive interference in processing the information due to an overload on the WM (Cassady and Johnson, 2002). Students who are prone to **test-anxiety** will experience cognitive interference either during the study process ahead of the test, during the test itself, or both. Interference during learning prior to the test could cause ineffective organisation of the studied material in the LTM and interference in creation of suitable schemas, something that will restrict their ability to retrieve the information later during the test (Nottelmann and Hill, 1977).

In the context of this research, it was hypothesised that an unfamiliar narrator constitutes a distraction and shifts the attention of the student to things that are unrelated to learning due to insufficient social cues. Therefore, an unfamiliar narrator can load the WM resources and cause cognitive overload, interfering with learning and performance of the task and if a student is in the state of anxiety, the cognitive load will increase even more and inhibit learning.

In summation, as rationalised before, since **conscientiousness** was found to be consistently positively related to academic achievement (Busato, et al., 2000; Gray and Watson, 2002; Chamorro-Premuzic and Furnham, 2003a), it was selected from among the ***Big Five*** personality traits as the trait that would be tested for interaction with voice familiarity in MM learning. In addition, since **conscientiousness** was found to be correlated with motivation (Costa and McCrae, 1992a) and in order not to load the model with interrelated motivational variables, **test-anxiety** which was found to be consistently negatively related to academic achievement and being the only affective motivational factor (Pintrich, et al., 1991) was chosen from among the motivational variables.

Following are the hypotheses that consider **conscientiousness** as a personal variable that might interact with voice familiarity. The assumption underlying the hypotheses was that encountering with an unfamiliar narrator exerts higher extraneous cognitive load. Thus, conscientiousness will have a greater effect with an unfamiliar narrator than with a familiar one.

3.10 Hypotheses related to conscientiousness and voice familiarity

Hypothesis 7.

The effect of **conscientiousness** on the learning efficiency indices will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

7.1 The influence of **conscientiousness** on the level of learning process efficiency (LPE) will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

7.2 The influence of **conscientiousness** on task performance efficiency (TE) will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

7.3 The influence of **conscientiousness** on the level of three-dimensional learning efficiency (3D-E) will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

7.4 The influence of **conscientiousness** on the level of motivation for task performance (MT) will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

Following are the hypotheses that consider **test-anxiety** as an affective motivational variable that might interact with voice familiarity. The assumption underlying the hypotheses was that encountering with an unfamiliar narrator exerts higher extraneous cognitive load and since high test-anxiety is characterised with high cognitive load, this trait will have greater effect in this less favourable learning condition.

3.11. Hypotheses related to test-anxiety and voice familiarity

Hypothesis 8.

The influence of **test-anxiety** on the learning and performance efficiency indices will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

8.1 The influence of **test-anxiety** on the level of efficiency of the learning process (LPE) will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

8.2 The influence of **test-anxiety** on the level of task performance efficiency (TE) will be higher among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

8.3 The influence of **test-anxiety** on the level of three-dimensional learning efficiency (3D-E) will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

8.4 The influence of **test-anxiety** on the motivation for task performance (MT) will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

To summarise this section, the aim of the research was to examine the possible influence of a familiarity with the narrator on the efficiency of learning, as well as the possible interaction with individual differences between the students. The personal traits that were examined in the research were **conscientiousness**, which is related to personality and **test-anxiety**, which is related to the affective aspect of motivational characteristics. Selection of these characteristics was based on researches that found a consistent positive correlation between **conscientiousness** and academic achievement and a consistent negative correlation between **test-anxiety** and academic achievement. The research examined the influence of **conscientiousness** and that of **test-anxiety** in a situation in which affective conditions exist (listening to a familiar voice or an unfamiliar voice) from the point of view of cognitive load. It should be noted that in all the studies that investigated the connection between personality traits and variables relating to motivation to academic achievement, the Grade Point Average (GPA) or the results of examinations in specific courses were examined. This study examined the influence of these variables on the cognitive load, on the efficiency of learning and on the motivation on task performance while experiencing MM learning material with various types of voices.

3.12 The gap in knowledge

The present study focused on the affective and performance aspects, expressed in the familiarity with the narrator in MM learning material. In summation of the above reviewed literature, the gap in knowledge the study aimed to fill was:

1. There is a lack of research, from the perspective of instructional design and HCI that studies the educational aspects of OER, in general and LOs, in particular, to ensure their effectiveness, when integrated into the learning environment. In the present research NVSCs, which may be used as RLOs, were studied from an affective and cognitive load perspective.
2. Most cognitive load research had been conducted under laboratory conditions with learning subjects irrelevant to students. This study was conducted in a natural learning situation with learning material relevant to students, which is expected to give a more accurate picture of cognitive load and performance.
3. Most studies had been done on pure self-study MM learning. No examination had been conducted on the influence of MM learning in a blended learning situation, where a subject was taught in the framework of a classroom lesson and where the student forms a connection with the teacher and is expected to study a new aspect of that subject while listening to the voice of an unfamiliar teacher.
4. In regards to social cues students receive from the narration, while interacting with the computer, studies were conducted in relation to the type of voice (human *versus*

computerised), accent of the narrator (local *versus* foreign) or the narration being personal (conversational speech *versus* formal speech) or polite. No research was found that investigated the influence of a familiar narrator *versus* an unfamiliar one on students' learning efficiency and motivation from cognitive load perspective.

5. In accordance with the assumption that an unfamiliar narrator elicits less social cues and thus, less positive social interaction, the study tried to find out whether student-narrator gender-similarity can compensate for that.
6. According to CATLM, affective variables should also be taken into consideration when studying differences between learning conditions. In this study, two affective variables, i.e. ***conscientiousness*** and ***test-anxiety*** were investigated for interaction with voice familiarity.

3.13 The conceptual framework of the research

The conceptual framework underlying this research is based on ***Cognitive Load Theory*** (Sweller, van Merriënboer and Paas, 1998; Sweller, Ayres and Kalyuga, 2011), as well as on other theories associated with it: ***Cognitive Theory of Multimedia Learning*** (Sweller, 2005a; Mayer, 2005a)***, Media Equation Theory*** (Nass and Reeves, 1996)***, Social Agency Theory*** (Mayer, 2005b) and ***Cognitive- Affective Theory of Learning with Media*** (Moreno, 2005). All of these, in the context described in Chapter 2 and visualised in Figure 2-1.

Cognitive Load Theory (CLT) is based on the assumption that cognitive load is created in the student's WM during learning, composed of an intrinsic load and an extraneous load. Intrinsic load is related to the nature of the material being studied and is inherent in it, whereas extraneous load is created as a result of deficient design of the learning materials. Accordingly, the prime goal of instructional design is to reduce the extraneous load to the maximum extent possible.

Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2005a) was proposed for dealing with MM learning material, in the framework of which an analysis was conducted of the factors that could contribute to extraneous load during study using MM learning materials and ways in which to minimise their effect through instructional design. The principles proposed by CTML served for the preparation of the Narrated Video Screen

Captures (NVSC), i.e. the MM learning materials that were used in the research. The aim of the research was to expand knowledge on which this theory is based and to examine whether the degree of familiarity with the narrator has any influence on learning through MM. The research also tried to address the suggestions made by the ***Cognitive-Affective Theory of Learning with Media*** (CATLM) (Moreno, 2005) and introduced students' characteristics related to motivation and academic achievement, i.e. ***conscientiousness*** and ***test-anxiety***. The theories from which the research hypotheses were derived include: ***Media Equation Theory***, proposed by Nass and Reeves (1996), which claims that the learner sitting in front of the computer is in social interaction with it as if with a real person and ***Social Agency Theory***, proposed by Mayer (2005b), based on ***Media Equation Theory***, whose main claim is that the more social cues the students receive during learning with the computer the less extraneous cognitive load they will experience, thus, the more effective will be their learning.

The assumption that led to the research hypotheses was that MM learning materials with narration by a teacher who is familiar to the student provides more social cues and that the student's learning will therefore be more efficient. The research hypotheses were also based on the *Similarity Attraction Principle*, proposed by Bandura (1997) in relation to human role models and in relation to interaction with the computer as suggested by Nass and Brave (2005) and Nass and Yen (2010). This principle too is based on social cues that the students are likely to receive during learning, when they feel that they are in interaction with a teacher who is similar to them. In this research, the influence of gender similarity was examined as a characteristic of the teacher most accessible to the students during learning through NVSC. The hypothesis was that when learning is done through MM learning material with narration by a voice that is not familiar to the student there will be a greater significance to social cues that the student receives if the gender of the narrator is identical to that of the student.

Numerous research atudies have been conducted focusing on the effectiveness of MM learning materials, in the wake of which principles were formulated, as proposed in the framework of CTML (Mayer, 2005a). The influence of the narrator's voice in MM learning materials on learning was examined, including accent, i.e. local or foreign (Nass and Brave, 2005), type of speech, i.e. formal or conversational (Louwerse, et al., 2005), politeness of the narrator (Nass and Reeves, 1996; Nass and Brave, 2005) and type of narration, i.e. human or computerised (Nass and Brave, 2005). Following criticism levelled at the methodology of previous research studies on the question of cognitive load – that they were conducted in artificial laboratory conditions with learning materials that were not relevant to the students, e.g. a tutorial about the Bicycle tire pump (Mayer and Sims 1994) or a tutorial about lightning formation (Mayer Sobko and Mautone 2003; Moreno and Valdez, 2005), presented to psychology students and without taking into consideration affective factors, as suggested by CATLM (Moreno, 2005) – it was suggested, that these aspects be taken into account in future research (de Jong, 2010; Mayer, 2010). Emphasis in the current research was placed on the fact that the research environment should be the natural environment of the students, including all natural learning components, such as sufficient time for learning, allowing them to revise sections in the framework of the video tutorials that were not clear on first viewing and the possibility of taking notes. The experiments were carried out as part of the regular lessons.

However, the emphasis in the research – a factor that was absent in other research – is the affective aspect, i.e. what happens to the student studying in a blended learning environment, when interaction takes place and a social relationship is formed with the course teacher. The assumption, according to theories dealing with adult learning, is that a personal relationship exists between the adult learner and the instructor (Knowles, 1984; 1990). In this study, student-teacher relationship was even more significant due to the teacher-centered way of teaching in class. No research was found that examined the significance of a familiarity with the narrator, with the study material being part of subjects in a traditional teacher-focused course being taken by the students. In addition, no research was found that examined the additional influence that might be to individual differences between students, such as conscientiousness and test-anxiety in interaction with the MM learning materials.

This research was concerned with examining the influence of a familiarity with the narrator on the student's perception of the learning materials' effectiveness, as well as the influence on cognitive load and task performance and consequently on learning efficiency indices. Familiarity with the narrator's voice was chosen as a central variable in the research because of its possible implications on the instructional design of computer literacy learning material. Investigating this issue is important for me as a computer literacy teacher because then I can make educational choices, for example, of whether to create my material using my own voice, which is highly time consuming, or minimise my workload by downloading appropriate materials from the internet, e.g. YouTube or any other LOs repository.

The conceptual framework of the research was based on cognitive theories relating to learning through MM learning materials. The research assumed that cognitive, as well as affective aspects of the learner must be taken into account. Thus, the conceptual framework of the research referred to a number of factors: Firstly, the level of cognitive load that is created during learning through various MM learning materials and is influenced by factors related to both the learning materials themselves and the student's traits. Secondly, the influence on learning of social cues that students receive from the various MM learning materials during interaction with the computer.

Thus, the conceptual framework that underpinned the current research included the following components:

A. **Cognitive load-** CLT claims that if the ***instructional design*** of the learning material is not properly managed, it will result in ***extraneous cognitive overload,*** which might impair learning, provided that the subject matter to be learned is not too simple, i.e. not low in element interactivity. Thus, the main purpose of ***instructional design*** is to minimise the ***extraneous cognitive load*** experienced by the student. CTML offers principles for the integration of audiovisual information in MM learning material in a way that minimizes ***extraneous load*** and hence the unavoidable impairment of learning.
B. ***Affective variables-*** CATLM suggests that cognitive processing is the result of the interaction between the learner's knowledge, abilities, beliefs, ***affect*** and ***motivation***. The theory suggests that individual differences play a great role in MM learning. In the present research, students' personal traits namely, ***conscientiousness*** and ***test-anxiety*** were incorporated.
C. ***Social interaction and social cues- Media Equation*** **Theory** suggests that people relate to computers, television and new media as real people. Thus, a ***social interaction*** occurs while interacting with the computer. ***Social Agency Theory –*** based on ***Media Equation Theory***, suggests that, ***social cues***, coming from MM learning material, can make learners feel in a social interaction with the computer

and thus, make them automatically activate the social schema, which consequently relieves the burden on the WM and allows more resources to be allocated for germane processes. ***Similarity Attraction Principle*** suggests that individuals tend to experience more positive ***social interaction*** with those similar to themselves, hence receiving more ***social cues***. In this research, the ***Similarity Attraction Principle*** was checked in relation to ***Gender Similarity***. The focus of the research was the influence of the ***familiarity with the narrator*** on students' learning from a ***cognitive load*** perspective.

Following is a model, which represents the conceptual framework of the study, demonstrating factors, which affect MM learning according to the theories on which the study is based:

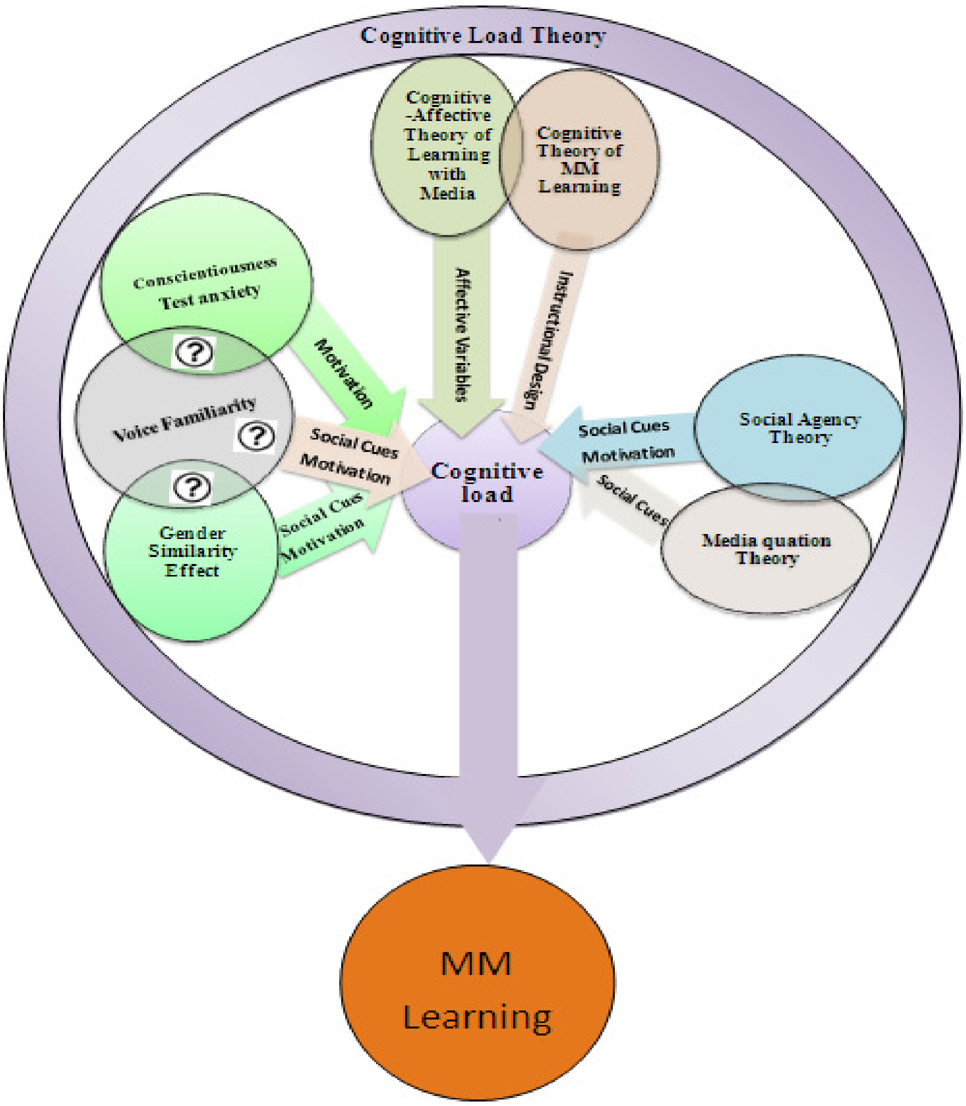

Figure 3-6: The conceptual framework of the research

The model proposed above presents the manner in which the concepts included in the conceptual framework are related to learning through MM learning materials. ***Cognitive Load Theory*** is in the background of all the other theories in the model. ***Cognitive Theory of MM Learning*** deals with **instructional design** that aims at reducing ***extraneous cognitive load***. ***Cognitive-Affective Theory of Learning with Media*** overlaps with ***Cognitive Theory of MM Learning*** because it draws on the later, but expands it to include individual different **affective variables**. ***Social Agency Theory*** overlaps with ***Media Equation Theory*** because it draws on the later, but suggests an impact of human-computer **social interaction** in learning through **social cues** and thus affecting **cognitive load**. The more **social cues** the more reduced **extraneous cognitive load** is experienced by the learners and the more positive **social interaction** the learners experience the more **motivation** they have to invest effort in germane processing and thus, learning is enhanced. According to the ***Similarity Attraction Principle***, ***Gender Similarity*** enables positive **social interaction** and thus, exerts **social cues**, reduces **extraneous cognitive load** and increases **motivation**. Personal characteristics exhibited by **conscientiousness** and **test-anxiety** are related to motivational aspects of learning and academic achievement while conscientiousness has positive influence and test-anxiety negative influence. The issues under study here relate to the impact of **voice familiarity** on MM learning under the assumption that a familiar voice elicits more **social cues.** Thus, decreasing extraneous cognitive load and eliciting higher **motivation.** Under study is also the possible interaction between **gender-similarity** and **personal characteristics** with **voice familiarity.** These interactions are demonstrated by the overlaps between **gender-similarity** and **voice familiarity** and between **personal characteristics** exhibited by **conscientiousness** and **test-anxiety** and **voice familiarity**.

The research examined the influence of a **familiarity with the narrator** on learning through MM learning materials, based on the theories presented. The assumption underpinning the research hypotheses was that these learning materials provide the student with social cues of various types and at various levels, with the level of the social cues influencing the cognitive load experienced by the student. The more social cues provided by the learning materials the more the cognitive load felt by the student is alleviated. The chief claim of the research was that narration by a known teacher provides more social cues, elicits higher motivation and will therefore have a more positive influence on learning. A further claim was that when students face MM learning materials with narration by a teacher who is not familiar to them, learning will be more efficient if they and the teacher belong to the same gender because of the social cues received as a result of social interaction with a person similar to them. In addition, the assumption was that affective factors and individual traits of the student also enter the learning picture, some of which have a negative influence on learning (test-anxiety) and some positive (conscientiousness). The present research was deductive in approach and was based on the above-mentioned theories. As part of the research, evidence was collected that could expand CTML from the point of view of additional factors that could affect learning with the help of MM learning materials. In addition, the research findings could reinforce and support ***Social Agency Theory*** and CATLM.

The following chapter will describe the research design and methodology.

Chapter 4 - Methodology

This chapter introduces the theoretical background underpinning the methodology, the research design and methods.

4.1 Research paradigm and methodology

This study was a positivistic, deductive, mixed-methods and a case study research**.** It was a mainly quantitative research, with additional qualitative and quantitative data collected after the initial statistical analysis, for corroboration and a further insight into the findings. The study aimed to illuminate and enrich the issues that emerged from the exploratory research (see Prologue) regarding additional factors involved in the students' learning, in order to understand whether in a blended learning environment the effectiveness of MM instructional material is dependent on the familiarity with the narrator. The hypotheses were based on existing theories regarding MM learning and instructional design from the perspective of cognitive load.

4.1.1 Positivism

Using a positivistic paradigm (Sabar Ben-Yehoshua, 1995; Cohen, Manion and Morrison, 2000; Bryman, 2001; Denzin and Lincoln, 2007), this research sought to reveal the impact of familiarity with the narrator in MM learning material on students, when the students have personal relationship with the course instructor, in the light of ***Cognitive Load Theory*** (Sweller, van Merriënboer and Paas, 1998), the ***Cognitive Theory of Multimedia Learning*** (Mayer, 2005a), ***Cognitive-Affective Theory of learning with Media*** (Moreno, 2005) and ***Social Agency Theory*** (Mayer, 2005b). Thus, for testing existing theories the research undertook a positivistic paradigm with a deductive approach.

Positivist paradigm assumptions about the nature of reality are based on the belief in the existence of one absolute reality, composed of facts and figures; simple components that can be reduced to objective statistical relationship (Sabar Ben-Yehoshua, 1995; Sabar Ben-Yehoshua, 2001).

According to Cohen, Manion and Morrison (2000), a ***positivistic paradigm*** is based on the four basic assumptions: ***determinism***, ***empiricism, parsimony and generality***. ***Determinism*** focuses on causality between events, ***Empiricism*** focuses on supporting theories by means of empirical evidences, ***Parsimony*** refers to the explanation of the phenomena in the briefest way possible and ***Generality*** assumes the possibility of generalising the observation to a larger population. In addition, positivism gives importance to research methods focusing on quantitative analysis like surveys, experiments and quasi-experiments.

The ***positivistic paradigm*** was criticised due to its lack of regard for the subjective states of individuals (Sabar Ben-Yehoshua, 1995; Cohen, Manion and Morrison, 2000; Sabar Ben-Yehoshua, 2001), in disregard to human intention, individualism and freedom in viewing and interpreting social reality. In this sense, positivist conception is in contradiction to that of the post-positivist paradigm. The post-positivistic paradigm perceives the realm of human structure as designed by cultural and personal conditions of the person and which does not exist without him/her, because the person under study is part of that reality which is constructed from interpretations made by the investigator and him/her (Sabar Ben-Yehoshua, 1995).

From the positivistic paradigm perspective, this research employed quasi-experiments and questionnaires for collecting quantitative data to help test the theories. However, semi-structured interviews were employed as well, to collect corroborative qualitative data regarding students' feelings and opinions for a deeper insight into the findings. The qualitative data was used for the construction of the close-ended follow-up questionnaire (Shah, 2004) that was administered after all the experiments had ended.

4. 1.2 Mixed methods research

The present research was a mixed methods study because it relied upon collecting both quantitative and qualitative data in order to examine how students' learning was affected by the familiarity and gender similarity of the learning material narrator.

Mixed methods research involves a combination of quantitative and qualitative approaches (Greene, 1997; Tashakkori and Teddlie, 1998; Creswell, 2003; Tashakkori and Teddlie, 2003; Bryman, 2007; Morgan, 2007; Leech and Onwuegbuzie, 2009). The use of mixed-methods is likely to increase the quality of the final results and to provide a more comprehensive understanding of the findings. Depending on statistical analysis only, it might be difficult to get a full understanding of the findings. Thus, adding a qualitative dimension to the quantitative one might help in getting a clearer picture.

Greene (1989, p. 256) suggested five factors when considering using mixed-methods approach.

- ***Triangulation***- in order to test the consistency of findings obtained through different instruments*;*
- ***Complementarity*-** in order to clarify results from one method with the use of another method*;*
- ***Development*-** results from one method may shape subsequent methods in the research process*;*
- ***Initiation*-** using more than one method may stimulate new research questions or challenge results obtained through one method*;*
- ***Expansion*-** using more than one method adds richness to the study*;*

In this study, a mixed-methods research design was used in order to encourage reflexive and more critical introspection into the data collected. The quantitative data collected during the quasi-experiments assumed the usage of the deductive approach and was statistically analysed, while the qualitative component added by semi-structured interviews was content analysed and set the base for a follow-up questionnaire, as suggested by Shah (2004). Thus, on one hand, more confidence in the findings could be achieved and on the other, new questions for future research could be suggested.

A variety of mixed-methods research designs exist: Tashakkori and Teddlie (2003) described 35 such designs, while Leech and Onwuegbuzie (2009) presented mixed methods design as a function of three dimensions:

- Level of mixing (partially mixed *versus* fully mixed);
- Time orientation (concurrent *versus* sequential);
- Emphasis of approaches (equal status *versus* dominant status);

In the research design, there was a partial mix between quantitative and qualitative methods, which were implemented in a sequential approach; first quantitative data were collected and analysed, then qualitative corroborative data were collected using semi-structured interviews, followed by quantitative corroboration data collection using a close-ended follow-up questionnaire. The predominant research strategy was quantitative. Quantitative methods were used to collect data to help refute or confirm the research hypotheses while qualitative tools were used to collect further insight into the findings and to set up a follow-up questionnaire for further quantitative data for corroboration.

In recent years, some researchers maintain that mixed methods research may be regarded as a third research paradigm in addition to the first two – quantitative research and qualitative research (Tashakkori and Teddlie, 2003; Creswell and Garrett 2008). Johnson, Onwuegbuzie and Turner (2007) suggest a definition that emphasises the central component in mixed methods research, namely, the use of both the quantitative and qualitative approach: 'Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration' (p.123).

However, there is no consensus among researchers regarding the need for defining mixed methods research as a third research paradigm. Some do see the advantages in this but also emphasise the challenges involved in combining different research methods. De Lisle (2011) claims that a challenge still exists with respect to conducting research that involves different methodologies. In a critique on the definition of mixed methods research as a third research paradigm, Symonds and Gorard (2008) claim that it is a question of triangulation, involving methods and not methodologies, also stating that the approach is too pragmatic. According to them, it is a mistake to consider it as being a third paradigm. To this, Teddlie and Johnson (2009) reply that pragmatism that combines quantitative research and qualitative research is, in fact, the philosophy behind mixed methods research and that there is nothing bad in it. On the contrary, a pragmatic approach allows deeper understanding of the research subject.

Mixed methods research has been found to be suitable for research in the field of education (Creswell and Garrett, 2008) and in the present study, mixing quantitative data with qualitative data allows the presentation of a strong body of findings and strengthens confidence in the results

4.2 The research aim

This research was conducted in a blended learning environment within the context of a ***Computer Literacy*** course in one college in Israel. The focus of the research was the influence of the familiarity with the narrator in NVSCs. The research addressed the influence of the familiarity with the narrator on students' learning in terms of their perceived effectiveness of the learning material, efficiency of the learning and the level of involvement on the task, i.e. motivation to perform the task. The research also sought an answer to the question of whether there is an interaction of student-narrator gender similarity and voice familiarity and whether individual differences exhibited by conscientiousness and test-anxiety have any influence in the matter.

In this study, the MM learning materials were NVSCs, which exhibited screen casts of a particular software accompanied by a narration, explaining a particular procedure of that software. There were NVSCs featuring four different narrators: familiar female, familiar male, unfamiliar female and unfamiliar male, in order to check the influence of familiarity with the narrator and the influence of narrator-student gender similarity.

4.3 Research hypotheses

Hypotheses regarding the influence of the familiarity with the narrator

Hypothesis 1: The learning and task performance efficiency indices (LPE, TE and 3D-E) of the students who heard a familiar voice will be higher than the learning and performance efficiency indices of students who heard an unfamiliar voice. The subcategories of Hypothesis 1 are detailed in section 3.7.

Hypothesis 2. The degree of motivation for performing a task (MT) in the case of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice.

Hypothesis 3. The NVSC's assessment score (NVSCA) of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice.

Hypotheses regarding the influence of similarity of gender between the student and the narrator

Hypothesis 4. The learning and task performance efficiency indices (LPE, TE and 3D-E) of students who heard an unfamiliar voice belonging to a gender identical to theirs will be higher than the learning and performance efficiency indices of students who heard an unfamiliar voice belonging to a different gender. There will be no influence of gender similarity when the voice of the narrator is familiar. The subcategories of Hypothesis 4 are detailed in section 3.8.

Hypothesis 5. When the voice is unfamiliar, the degree of motivation for task performance (MT) of students who heard a voice belonging to an identical gender will be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the degree of motivation for task performance (MT) with students who heard a voice belonging to an identical gender *vis-à-vis* students who heard a voice belonging to a different gender.

Hypothesis 6. When the voice is unfamiliar, the NVSC'A assessment score (NVSC-A) of students who heard a voice belonging to an identical gender will be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the assessment grade of the NVSC of students who heard a voice belonging to identical gender *vis-à-vis* students who heard a voice belonging to a different gender.

Hypotheses regarding the influence of conscientiousness

Hypothesis 7. The influence of conscientiousness on the learning efficiency indices and motivation on task will be greater among students who heard an unfamiliar voice *vis-à-vis* students who heard a familiar voice. The subcategories of Hypothesis 7 are detailed in section 3.10.

Hypotheses regarding the influence of test-anxiety

Hypothesis 8. The influence of test-anxiety on the learning and performance efficiency indices and motivation on task will be greater among students who heard an unfamiliar voice *vis-à-vis* students who heard a familiar voice. The subcategories of Hypothesis 8 are detailed in section 3.11.

4.4 Educational research model-defining the variables

Dunkin and Biddle (1974) presented a model that provides a framework for research addressing the subjects of teaching and learning. The model they presented is based on an original study by Mitzel (1960) who claimed that teaching must take into consideration a number of variables: teacher, student, interaction between teacher, student and learning materials and the results of these interactions. The original model referred to traditional classroom teaching but, despite being outdated, it still provides a decent background and framework for research in teaching and learning with necessary adaptations. Dunkin and Biddle expanded Mitzel's original model and proposed four types of variables that are involved in the learning process:

- ***Presage variables***: these relate to the teacher and could influence teaching. These variables may include the teacher's intelligence level, educational level, age, experience, socio-economic status, knowledge of the subject matter, gender, race, life experience and also voice and speech characteristics, appearance and personality characteristics ;
- ***Context variables***: these relate to the learner and could influence learning. These variables may include gender, socio-economic background, personality traits, intelligence, motivation, anxieties and all sorts of life experience ;
- ***Process variables***: these describe the learning activity and the interaction between teacher and learner;
- ***Product variables***: these are the results of learning (Dunkin and Biddle, 1974; Gage, 2009);

The following figure (Figure 4-1), visualises the model suggested by Dunkin and Biddle (1974):

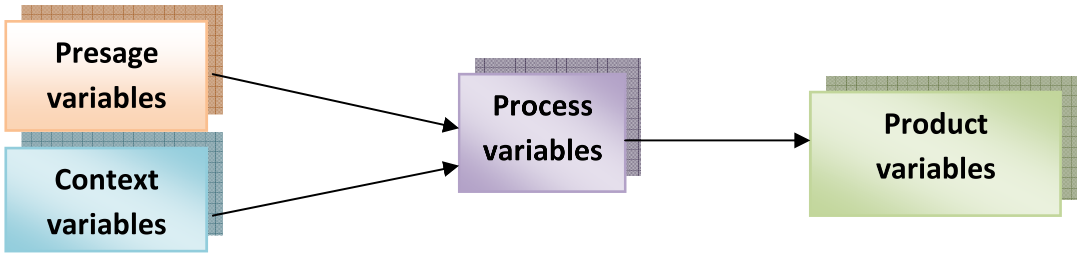

Figure 4-1: Outline of an educational research model

According to Figure 4-1, there is an impact of teacher and learner variables in the interaction that takes place during the learning process. According to this model, the presage and context variables affect the process variables and the variables that are associated with the learning process influence the result.

In this research, the influence was examined of viewing MM study materials with narration performed by a familiar *versus* an unfamiliar narrator. An examination was also made of the influence exerted by narrators of the same gender as the student or narrators of the opposite gender. The rationale for the dependent variables, i.e. LP- learning process efficiency, TE-task efficiency, 3D-E-three dimensional learning efficiency and MT-motivation on task, was established in sections 3.1.4 and 3.1.5 and stemmed from the literature review related to CTML (Mayer, 2005a) and ***social agency theory*** (Mayer, 2005b). In addition, NVSC-A- assessment of the NVSC was established in order to assess students' perception of the NVSC. Additionally, the influence of students' personal traits (***conscientiousness*** and ***test-anxiety***) was investigated, stemming from CATLM (Moreno, 2005) and rationalised in sections 3.9.1.1 and 3.9.2.1 respectively. According to Chalmers (2003), when investigating computer related performances, user characteristics that need to be considered are age, gender, the level of expertise with regard to learning content, the level of expertise with regard to computer usage, affect and motivation. In this study affect, represented by conscientiousness and test-anxiety served as independent variables and motivation on task was calculated as a dependent variable as explained before. Thus, four student characteristics, namely, age, gender, matriculation grades (representing students' prior academic entry qualifications) and prior computer experience, which were also found in the literature to be predictors of academic achievement, were tested for correlation with the dependent variables. In the case of such a correlation, these variables were used as ***covariates***. Covariates are independent variables that have effects on the dependent variables and are of no direct interest in the study (Everitt, 2002). In this study, there were four independent variables that were of interest, namely, voice familiarity, gender similarity, conscientiousness and test-anxiety. Other independent variables that could affect the dependent ones had to be controlled in the statistical analysis. The above mentioned students' characteristics were found in the literature to be correlated with academic achievement, as well. Thus, controlling them in the statistical analysis allowed a more accurate picture of the influence of voice familiarity and the other independent variables, which were of interest here, on the learning efficiency indices. Decision about the variables was made in compliance with the research aims and hypotheses. Since the research was not concerned with the relation of these variables to the research hypotheses, they were controlled whenever a correlation was found. Thus, allowing testing the possible effect of voice familiarity on students' learning efficiency indices, while neutralising the possible influence the covariates, e.g. gender or previous computer experience, might have on these indices, as will be demonstrated in the following sections, in relation to the present study's population.

4.4.1 Defining the covariates

4.4.1.1 Age

The research population comprised adult students with a minimum age of 19 years and a maximum of 45 (see Table 4-3). This range of ages called for a concern related to the influence of the students' age on the dependent variables of the research, since a few studies found that age is correlated with academic success (Eaton, 1980; Sadler-Smith, 1996; Graham, 1998; Justice and Dornan, 2001; Richardson and Woodley, 2003; Shanahan, 2004). Thus, in this study, age was tested for correlation with the dependent variables. As seen in Table 5-1, age did not have any correlation with the dependent variables. This finding is in line with Chalmers (2003), who claims that age should be taken into consideration although it is less important than computer related experience.

4.4.1.2 Gender

Chalmers (2003) claims that men and women respond differently to computers. Moreover, gender was also found to be correlated with academic achievement. A review of the literature dealing with gender differences in relation to academic achievement found mixed findings (Galicki and McEwen, 1989; Bridgeman and Wendler, 1991; Ryland, Riordan and

Brack, 1994; Jacobs, 1996b; Jacobs, 1996a; Hu and Kuh, 2002; DiPrete and Buchmann, 2006). Some studies found that women reach better results in certain subject areas such as nutrition and diet, humanities, social sciences and life sciences (Alon and Gelbgiser, 2011), whereas men reach higher in content areas related to technology and economics (Keller, Crouse and Trusheim, 1993; Schram, 1996; US Department of Education: National Center for Education Statistics [NCES], 2005). However, other studies observed superiority of the female gender to men in many more content areas (Ayalon, 2003; Goldin, Katz and Kuziemko, 2006). Due to the ambiguous findings related to the correlation between gender and academic achievements, in the current research gender was tested for correlation with the dependent variables. As seen in Table 5-1, gender correlated with some of the dependent variables. However, the research was not concerned with the difference between male and female students and gender was used only for the creation of the gender similarity variable. Thus, in order to neutralise the possible effect of gender on the dependent variables in this study, gender was used as a covariate in the ***Multivariate analysis of covariance*** (MANCOVA) tests.

It should be noted that gender is a dichotomous variable coded as binary. The SPSS ™ software, which was used for the MANCOVA tests in this study, assumes that all covariates are quantitative variables, and the adjusted means are adjusting for the covariates by fixing them at their means. Hence, fixing a categorical variable at its mean may be problematic. However, many researchers use this strategy by applying a binary control variable, especially when they do not have the ability to randomly assign people to the groups (Acock, 2008), as was the case in the present study.

The correlations between gender and the dependent variables:
LPE-Rec-($r=-0.010$, $p>0.05$);
LPE-Trn-($r=-0.046$, $p>0.05$);
TE-Rec-($r=-0.053$, $p>0.05$);
TE-Trn-($r=-0.144$, $p<0.01$);
3D-E-Rec-($r=-0.058$, $p>0.05$);
3D-E-Trn-($r=-0.123$, $p<0.05$);
MT-Rec-($r=0.197$, $p<0.01$);
MT-Trn-($r=0.184$, $p<0.01$);

NVSC-A-($r=-0.079$, $p>0.05$);

In this research the gender categories were: 1-'male'; 2-'female'. Thus, negative correlations between an index and gender means, that males scored higher than females on that index and whenever there is a positive correlation, it means that females scored higher than males.

4.4.1.3 Matriculation Examination Score

As suggested by Chalmers (2003), the students' level of education was taken into consideration and checked for possible correlation with the dependent variables. The research population of this study comprised of first year students with no previous HE experience, thus, the only entry qualifications data were their matriculation examination scores. These scores may be regarded as equal to high school GPA, which was found to be a predictor of academic success (Boldt, 1986; Anastasi, 1988; Galicki and McEwen, 1989; Mouw and Khanna, 1993; Wolfe and Johnson, 1995; ACT, 1997; Daugherty and Lane, 1999). Thus, matriculation examination score was tested for correlation with the dependent variables. As seen in Table 5-1, matriculation examination scores did not have any correlation with the dependent variables.

4.4.1.4 Computer experience

According to Rozell and Gardner (2000), computer experience is the most important antecedent for level of success with computer related tasks. The students who participated in the study were novice concerning a scholarly use of MS Office^{TM} software package. However, most of them had some kind of prior experience with the computer, e.g. e-mailing, computer games or social-media interactions. Since the NVSCs and the following tasks in the study required usage of the computer, the students were requested to rate their prior experience with it on a 1 to 5 scale (1-'Never used, 2-'Once a month', 3-'Once a week', 4-'Almost every day', 5-'A few times a day') see Appendix L question B. Data collected showed that 16 (4.2%) never used it before the course, 12 (3.1%) used it once a month, 22 (5.8%) – once a week, 140 (36.6%) - almost every day and 192 (50.3%) - a few times a day. The average score was 4.26, which means that most of the students were highly experienced with the computer and that score was tested for correlation with the dependent variables. As seen in Table 5-1, computer experience correlated with the dependent variables. However, the research was not concerned with the impact of computer experience on the dependent variables. In order to neutralise the possible effect of computer experience on the dependent variables in this study, computer experience was used as a covariate in the MANCOVA tests.

The correlations between computer experience and the dependent variables:

LPE-Rec-($r=0.141$, $p<0.01$);

LPE-Trn-($r=0.142$, $p<0.01$);

TE-Rec-($r=0.153$, $p<0.01$);

TE-Trn-($r=0.171$, $p<0.01$);

3D-E-Rec-($r=0.147$, $p<0.01$);

3D-E-Trn-($r=0.163$, $p<0.01$);

MT-Rec-($r=0.038$, $p>0.05$);

MT-Trn-($r=0.008$, $p>0.05$);

NVSC-A-($r=0.141$, $p<0.01$);

In summation, a significant correlation was found between students' gender and computer experience and the dependent variables. However, these variables were not of interest in regards the research hypotheses. Therefore, they were controlled in the MANCOVA tests. Thus, in relation to Dunkin and Biddle's model the following variables were examined in the framework of the present research, with gender and prior computer experience used as covariates:

- ***Presage variables***: instructor characteristics - the voice of the narrator in the video (familiar/unfamiliar) and gender similarity with students;
- ***Context variables***: student characteristics – gender and previous computer experience as covariates, **conscientiousness** as a personality trait and **test-anxiety** as an affective motivational variable;
- ***Process variables***: interaction taking place between the variables of the virtual teacher in the NVSC and the student variables, with the learning activity taking place during the course of viewing and listening to the NVSC in which narration was by different narrators, followed by a test;
- ***Product variables***: the products that were measured following the learning process, included performance of recall and transfer tasks, cognitive load during performance of the tasks and during learning and the calculations derived from them relating to the efficiency of the learning process (LPE), efficiency of task performance (TE),

integrated three-dimensional learning efficiency (3D-E), the degree of involvement (motivation) in performance of the task (MT) and students' perception of NVSC (NVSC-A); The following figure (Figure 4-2), demonstrates the Dunkin and Biddle's (1974) model reflected in the present study:

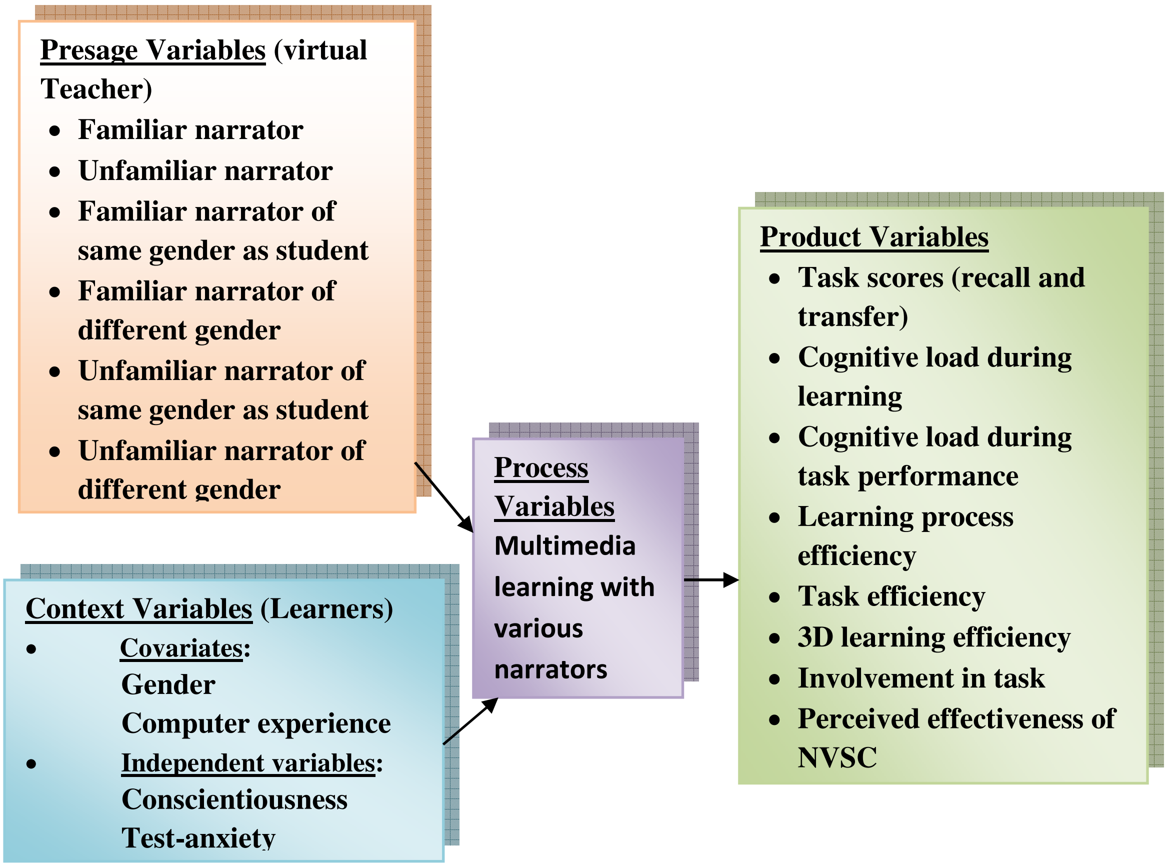

Figure 4-2 : The educational research model of the present research

4.5 Case study methodology

This study examined students studying a particular course in one college; therefore, it was found appropriate to use here the case study methodology.

Case studies, very frequently, employ both quantitative and qualitative methods. What distinguishes a case study is that the researcher is usually concerned to explain the unique features of the case. Thus, the approach assumed in a case study is an idiographic one, trying to understand the meaning of contingent, accidental and often subjective phenomena (Kirk, 1995).

Researchers define the case study in different ways:

- A theoretical report that analyses a complete social unit, in terms of qualitative research (McCartney, 1970);
- The study of an instance in action (Nisbet and Watt, 1984);
- The observation and collecting of data of human activity in a certain time and place (Stake, 2000; Bryman, 2001);
- A learning process regarding a certain unit – a person, event, program, organisation, a certain time, critical event or community (Bryman, 2001);

Although a case study is an observation of the unique specific case which is studied in depth, as an approach it calls for a comprehensive view and for the use of a number of methods, such as interviews, observations, fieldwork, analysis of documents and questionnaires. Therefore, not all case studies should be seen as research belonging to the stream of qualitative research, although most of them are such (Yin, 1994; Stake, 2000).

Following Selltiz (1965), Yin (1994) specified three types of case study in terms of their outcomes:

- An exploratory case study is seen as exploratory for other studies or research questions;
- A descriptive case study provides narrative accounts;
- An explanatory case study tests theory;

In this study, the exploratory research work preceded the main research (see Prologue) and brought up the research question and consequently the research hypotheses. Thus, this research was an explanatory case study aimed at shedding light on the findings of the exploratory research by testing existing theories.

A case study can be either inductive, i.e. trying to establish a new theory, based on existing ones, or deductive, i.e. testing an existing theory (Bryman, 2001). This research was a deductive case study testing existing learning theories relating to: ***CLT*** (Sweller, Ayres and Kalyuga, 2011), ***CTML*** (Mayer, 2005a), ***CATLM*** (Moreno, 2005) and ***Social Agency Theory*** (Mayer, 2005b). Thus, the research sought to find a connection between the theories and the subject under study; the influence of the familiarity with the narrator in MM learning.

Being a case study, this research raises issues of reliability and generalisability (Yin, 1994; Merriam, 1998; Johnston, Leach and Liu, 1999). Yin (1989) stated that generalisation is influenced by the set of methodological qualities of the case study and the rigour of its construction. Hillebrand (2001) disagreed with the claims about the lack of generalisability in case studies and said that there are two ways to generalise case study results to a larger population. The first approach relies on predicting the results for specific cases and testing whether they support the theories on which the study is based. However, the problem with this approach is that this might require a large number of cases. The second approach proposes that a case study might be generalisable to a larger population on the basis of both structural similarity and logical argumentation. Thus, case studies should be judged on the theoretical generalisability rather than on the statistical generalisability. Evidently, the literature shows that the issue of generalisability in case studies is controversial, thus, it should be left for the reader to decide, based on all the details given by the researcher (Cohen, Manion and Morrison, 2000).

A case study was found to be the appropriate research design, since it does not require a minimum number of cases, or the need to randomly 'select' cases. The researcher is supposed to conduct the research with the situation that presents itself. In this research, the research population was not randomly assigned and it dealt with students in a specific course in one college. Thus, validity is a concern here as well.

Construct validity is especially problematic in case study research because of potential investigator subjectivity (Yin, 1994). To ensure construct validity in this research multiple sources of quantitative evidence were collected, namely, NVSC assessment, tests performance and mental effort.

Internal validity is a concern in causal cases. This is usually a problem of interpretations in case studies and can be dealt with using ***pattern-matching***. ***Pattern-matching*** is a situation where several pieces of information from the same case are related to the theoretical proposition (Campbell, 1975). In this study, NVSC assessment scores, tests performance and mental effort scores, which were measured three times for each student, were related to the theories underpinning the research hypotheses.

External validity deals with knowing whether the results are generalisable beyond the particular case. Some of the criticism against case studies in this area relate to single-case studies. However, that criticism is directed at the statistical and not the analytical generalisation that is the basis of case studies. Yin (1994) asserted that external validity could be achieved from theoretical relationships and it is the development of a formal case study protocol that provides the reliability that is required of all research. The protocol Yin (1994) offered serves as guidelines for designing case study research. According to this protocol, the researcher presents an overview of the project, including the project aims, handling field procedures (e.g. entry permission) and making research questions clear in mind while collecting data and guidance of the way findings would be reported. This research used these suggestions as guidelines in designing the case study.

Triangulation is a common practice in case studies by providing multiple instances of evidence using different sources, in order to ensure accuracy and alternative explanations (Miles and Huberman, 1994). Triangulation can occur with data, theories or methodologies (Denzin, 1984; Stake, 1995). In this study, triangulation was made with data collected by means of assessment questionnaire, test performance and mental effort questionnaires. Triangulation was also made by basing the hypothesis on ***Social Agency Theory*** (Mayer, 2005b), CLT (Sweller, 1998), CTML (Mayer, 2005a) and CATLM (Moreno, 2005).

4.6 Quasi-experimental research design

A quasi-experiment is a scientific research method primarily used in the social sciences. The main difference between an experiment and a quasi-experiment is the lack of random assignment of the population in the study (Kirk, 1995; Shadish, Cook and Campbell, 2002). Quasi-experimental designs are often chosen for field studies where the random assignment of experimental subjects is impractical, unethical, or impossible. In the present research, a quasi-experimental design was selected because the experiments were meant to be part of the natural learning setting. Thus, no random sampling of the participants could be made.

In this study, research was conducted in a real learning situation, as also suggested by Mayer (2010) in his response to de Jong's (2010) criticism of the methodology used in most cognitive load studies, i.e. research under artificial laboratory conditions. In order to test the hypotheses of the study an experimental design was needed. However, since the aim of the researcher was to test the hypotheses in a natural realistic learning environment, all students enrolled in the ***Computer Literacy*** course were potential participants in the research. Thus, the population was not randomly assigned, rendering this design a quasi-experimental one.

Yet, research studies that are carried in a realistic situation rather than in a laboratory setting may show a more accurate picture of students' cognitive load and performance because they allow the students to practise their preferred way of study. First, in a natural setting, when there is no time pressure students may repeat learning segments that were unclear to them, provided that the learning material is self-paced. Secondly, in a realistic learning situation students might take notes to offload memory. It was suggested that taking notes during learning may alleviate load from WM by storing information in an external storing space (van Meter, Yokoi and Pressley, 1994) hence, students may show better performance (Bodemer and Faust, 2006). Moreover, since students are used to taking notes and they even assume a strong positive correlation between note-taking and success in task performance, especially when they know the learning material will not be available during task performance, forbidding note-taking may exert an additional cognitive load, which is not directly related to the instructional design in study (Moos and Azevedo, 2006; Moos, 2009). However, it is also worth mentioning that there are some indications that show that note taking during learning may impair later performance (Gil, Vidal-Abarca and Martímez, 2008). Students participating in this research, were allowed to take notes when necessary and sufficient time was allocated for reviewing problematic issues presented in the NVSCs (20 minutes were allocated for an eight to nine minute video passage), since the experiment aimed to reproduce a natural learning situation. The students' notes were not collected as enough data were collected via questionnaires, test files assessments and interviews and no additional support was needed using other tools in order to reach theoretical saturation, i.e. reveal the pattern of relationships between the variables under study (Bryman, 2008). Time was restricted to no more than 20 minutes, in order not to exceed the student's attention span (Bunce, Flens and Neiles, 2010).

Unlike this study, most of the studies related to MM learning included learning material which was not part of students' studies and/or interest, while research shows that learners with high interest in the learning content will more likely adopt a higher germane load than learners with low interest (Renninger, Hidi and Krapp, 1992). In most studies, time allocated to the study phase was restricted and, no note-taking was allowed (Moreno, 2004; Moreno and Valdez, 2005; Hasler, Kersten Sweller, 2007; Stull and Mayer, 2007; DeLeeuw and Mayer, 2008; Mayer and Johnson, 2008; Ignacio Madrid, van Oostendorp and Puerta Melguizo, 2009). Very few studies were held in a naturalistic environment (de Jong, 2010). One example of such a study, done by Tabbers, Martens and van Merriënboer (2004) and another one conducted by Kissane, et al. (2008), reached results which contradicted the *Modality Effect* (Brünken, Plass and Leutner, 2004; Tabbers, Martens and van Merriënboer, 2004; Ginns, 2005; Clarebout and Elen, 2007; Wouters, Paas and van Merriënboer, 2009). Thus, they called it the *Reverse Modality Effect* and explanation given for that result was the fact that MM learning material was learner-controlled and sufficient time was allocated for learning (Opfermann, Gerjets and Scheiter, 2005), suggesting that studies taken under artificial situation may render different results than studies undertaken under a realistic environment.

Utilising quasi-experimental design minimises threats to external validity, as natural environments do not suffer the same problems of artificiality as compared to a well-controlled laboratory setting, thus, allowing some generalisations to be made (Shadish, Cook and Campbell, 2002). However, this same kind of design may threaten the internal validity of the research because lack of randomisation leads to lack of control over extraneous variables, thus, affecting the causation assessment. This threat will have to be taken into consideration, when deriving conclusions from the findings.

The students were aware of the fact that the information collected would be analysed for the purpose of research into teaching improvement (Appendices K and M). However, students were not aware of the actual interest of the research ~ the influence of an unfamiliar narrator, in order to avoid 'contamination' of the study (Bulmer, 1982; Silverman, 2000).

In summation of the study's experimental learning conditions, quasi-experiments were held as a part of class exercises, subjects learned were course relevant, including gaining credits for the course. Note-taking was allowed and the time allocated for the learning phase was 20 minutes for an eight to nine minute learner-controlled NVSC.

The following table describes the design of the quasi-experiments. The table details the 12 groups of students that took part in the research. However, it should be noted that the 12 groups of students were combined together into two groups: those who heard a familiar voice (180) and those who heard an unfamiliar voice (202) and then into four groups with the additional aspect of gender similarity as demonstrated in Table 4-2.

:

Table 4-1: The 12 quasi-experiments carried out with multimedia learning materials (NVSC)

	Enrolled in the course	Participated in the study (rate of response)	male	female	NVSC Word™*	NVSC Power Point™**	NVSC Excel™***
Group-1	41	32 (78%)	17	15	Familiar Female		
Group-2	43	33 (77%)	15	18	Unfamiliar Female		
Group-3	44	37 (84%)	16	21	Unfamiliar Male		
Group-4	35	28 (80%)	19	9	Familiar Male		
Group-5	38	30 (79%)	13	17		Familiar Female	
Group-6	39	32 (82%)	15	17		Unfamiliar Female	
Group-7	39	32 (82%)	13	19		Unfamiliar Male	
Group-8	40	30 (75%)	18	12		Familiar Male	
Group-9	38	29 (76%)	9	20			Familiar Female
Group-10	42	35 (83%)	18	17			Unfamiliar Female
Group-11	45	33 (73%)	15	18			Unfamiliar Male
Group-12	37	31 (84%)	17	14			Familiar Male
Total	481	382 (79%)	185	197			
		Total familiar voice-180			60	60	60
		Total unfamiliar voice-202			70	64	68

*The subject being taught and tested using MS Word™: Designing a multilevel list (Appendix F)

** The subject being taught and tested using MS PowerPoint™: Designing an interactive presentation (Appendix G)

*** The subject being taught and tested using MS Excel™: Calculating subtotals and exhibiting a related chart (Appendix H).

As seen in Table 4-1, the experiments were held in three different periods. Every four groups experienced an identical NVSC with only one difference- the voice of the narrator.

The following table demonstrates the distribution of the students by voice familiarity and gender similarity:

Table 4-2 : Distribution of the groups by voice familiarity and gender similarity

		Gender Similarity		
		Same Gender as Student	**Different gender than student**	**Total**
Voice Familiarity	**Familiar Voice**	106 (28%)	74 (19%)	180 (47%)
	Unfamiliar Voice	96 (25%)	106 (28%)	202 (53%)
	Total	202 (53%)	180 (47%)	382 (100%)

As seen in Table 4-2, during the quasi experiments 180 (47%) students were exposed to a familiar voice, out of which 106 (28%) were exposed to a familiar voice of the same gender as theirs and 74 (19%) were exposed to a familiar voice of the opposite gender. The number of students who were exposed to an unfamiliar voice was 202 (53%), out of which 96 (25%) students were exposed to an unfamiliar voice of the same gender as theirs and 106 (28%) students were exposed to an unfamiliar voice of the opposite gender. A total of 202 (53%) students were exposed to narrator of the same gender and 180 (43%) were exposed to a narrator of the opposite gender.

4.6.1 Research variables:

In the present research, a 2X2 factorial design was adopted:

4.6.1.1 Independent variables

1. Voice familiarity:
    - Familiar voice;
    - Unfamiliar voice;
2. Voice familiarity and gender similarity :
    - Familiar voice of the same gender as student;
    - Familiar voice of the opposite gender;
    - Unfamiliar voice of the same gender;
    - Unfamiliar voice of the opposite gender;
3. Conscientiousness;
4. Test-anxiety;

4.6.1.2 Dependent variables

1. Learning Process Efficiency in recall task (LPE-Rec);
2. Learning Process Efficiency in transfer task (LPE-Trn);
3. Task Efficiency in recall task (TE-Rec);
4. Task Efficiency in transfer task (TE-Trn);
5. Three Dimensional Learning Efficiency in recall task (3D-E-Rec);
6. Three Dimensional Learning Efficiency in transfer task (3D-E-Trn);
7. Motivation on recall task (MT-Rec);
8. Motivation on transfer task (MT-Trn);
9. NVSC Assessment (NVSC-A);

4.6.1.3 Covariates

1. Gender;
2. Computer experience (see section 4.4.1);

4.6.2 The rationale for the experiments' design

Each student heard only one NVSC, such that assessment and evaluation were objective and not based on a comparison with a previous NVSC. Since each student heard only one NVSC, no situation was created in which the student got used to that mode of learning.

There were three NVSCs for each of the four types of voice – one for each of the MS Word™, MS PowerPoint™ and MS Excel™ materials~12 NVSCs altogether. Such that, if there was a difference in the level of difficulty between the different programs, which might affect the study's results (Paas, Renkl and Sweller, 2003), this was neutralised by having a NVSC in each of the voices for each of the programs.

According to this arrangement, each voice was tested three times with the three different programs with different students. Each of the voices was played to the first four groups in Word™. Following this, each of the voices was played to the following four groups in the teaching of PowerPoint™ and finally, each of the voices was played to four additional groups in the teaching of Excel™.

To summarise, in the design chosen, each of the voice types received identical conditions from the point of view of the exposure of the students to work with the computer and type of software. In addition, each student heard only one NVSC, so that they could evaluate it objectively without comparison with other NVSCs.

4.6.3 The quasi-experimental process

The students were notified ahead of time about a scheduled class exercise and were advised to bring in their own headsets in case they preferred to do so. Nevertheless, headsets were available for everyone in class. The whole experimental process including preliminary technical explanations, MM learning, tasks performance and questionnaires lasted about two hours.

At the beginning of the experiment, the familiar course teacher was present, introducing the class exercise, the location of the NVSC and test files on the server and distributing the headsets. The students were told that they were going to have a class exercise using an eight to nine minute NVSC for a period of 20 minutes of self-study and that it would be followed by an assessment questionnaire and a class task that was 2% of the final course grade. Students were told that the purpose of the study was improving future NVSCs. Therefore, their input and assessment was significant. Although the students were told that the class exercise was part of a research study regarding MM learning material, there was no mention of the focus of the study in order to prevent bias. The students received an information sheet (Appendix K) and consent form (Appendix M) for their approval. The teacher was then replaced by a technician for 20 minutes when all the students were engaged with the NVSC. No help relating to the subject matter being studied was given to the students. Help however, was given in case of technical problems with the computer or headphone sets. The presence of the familiar teacher at the beginning of the lesson and right after the NVSC experience, for the task performance, was meant to highlight the natural learning environment. The replacement by a technician was meant to avoid any additional social cues related to the familiar teacher, when listening to the NVSC other than those in the NVSC itself. The presence of the technician was natural, since that was a situation of self-study, which required assistance for technical problems only. Following is Figure 4-3, which visualises the quasi-experiment procedure and data collection:

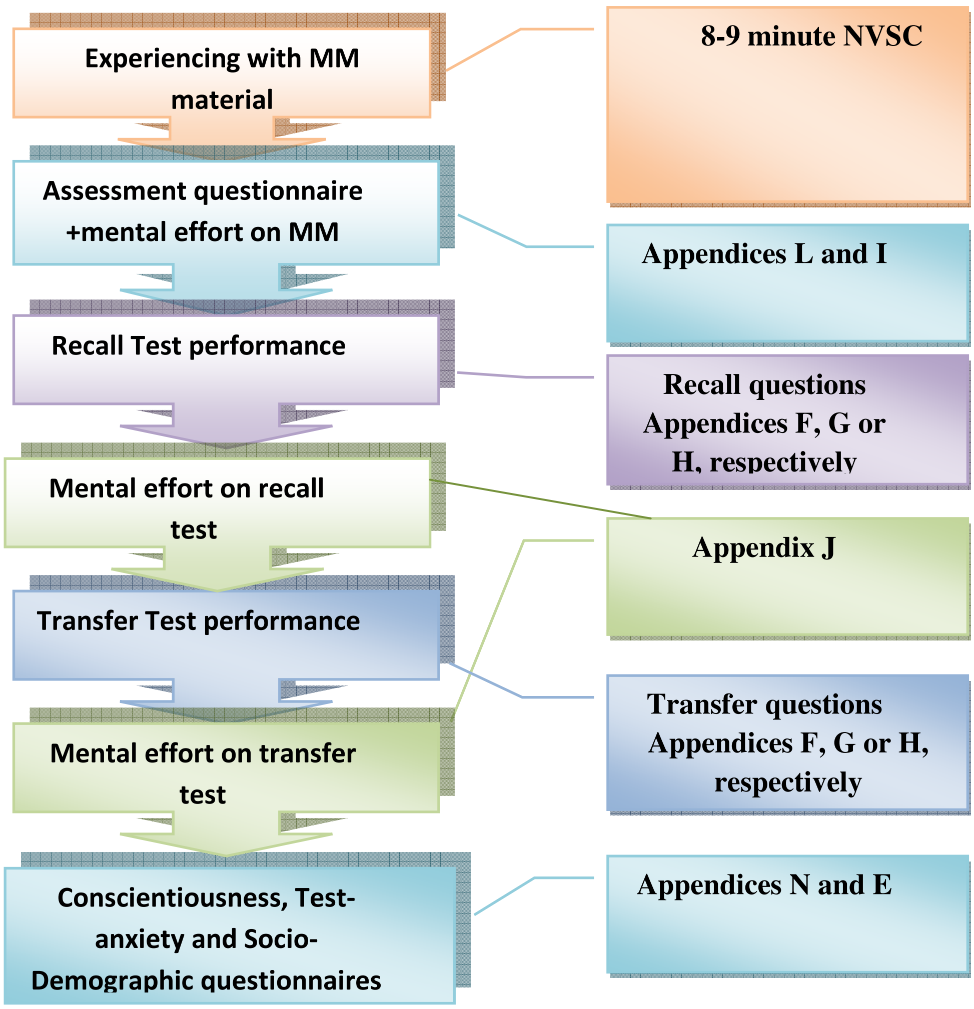

Figure 4-3: Quantitative data collection during each quasi-experiment

After 20 minutes of self-studying, the headphone sets were collected and the NVSC was removed from the server. The students were asked to complete a close-ended assessment questionnaire regarding their perceptions of the NVSC (Appendix L) and a one-item mental effort questionnaire, on a 1 to 9 scale (Paas, 1992; Paas, et al., 2003), see Appendix I. After completing the questionnaires, students performed a recall test and a transfer test (Appendices F, G or H respectively), while completing two more mental-effort questionnaires, one after the recall part and one after the transfer part (Appendix J). At the end of the experiment session students completed **conscientiousness** (Appendix N), **test-anxiety** and socio-demographic questionnaires (Appendix E).

The recall part of the test included task requirements exactly like the skills demonstrated in the NVSC, using the same set of data. The recall part was of an ***Aided Recall*** test, because the students did not have to recall all the details from memory, like in a pure recall test, since they were working with the software, which in itself has the capability of reminding the student of what should be done. The transfer part of the test included task requirements on a different set of data, with questions related to the skills demonstrated in the NVSC but not the same. In the transfer part, the students had to demonstrate an understanding of the skills taught previously and show they could use it in a different situation.

The two tests' performance scores (recall and transfer) and three mental-effort scores (during learning, during recall test and during transfer test), were used for calculations of three learning efficiency measures (TE-Task Efficiency, LPE-Learning Process Efficiency and 3D-E -Three-Dimensional Efficiency) (van Gog and Paas, 2008) and motivation on task (MT) (Paas, et al., 2005). See also Equation 3-1, Equation 3-2 Equation 3-3 and Equation 3-4. Data collected from the close-ended assessment questionnaires (Appendix L) was analysed for students' perceived effectiveness of the NVSC (NVSC-A).

4.7 Convenience sampling and the role of the researcher

This section describes the role of the researcher in conducting the research with convenience sampling and the means used to minimise the threats to research validity in relation to the researcher's objectivity, neutrality and biases.

Students participating in the research were selected because of their convenient accessibility to the researcher. This renders it to be a convenience sampling (Burns and Grove, 2005). Convenience sampling is a drawback regarding the external validity of the study, imposing a limitation in generalisation to a larger population. Alternatively, the sample for this study would have been adult students participating in different kinds of courses, or else, students participating in a specific course studying with different instructors. However, at the time of the research other types of sampling were not available and the researcher's students were the ones that could provide the data needed for the study. Moreover, the researcher wanted to study her learning material with her own students within her subject field (Rowland, 2000; 2012). Thus, convenient sampling was chosen.

The research population consisted of students enrolled in the ***Computer Literacy*** course, where, 226 students were taught by the researcher and 156 were taught by a male colleague, in order to introduce a familiar male voice as well.

The researcher's role as an insider researcher derives from the fact that she was a practitioner investigating her own domain of work. Her status as the course lecturer was clear. Thus, as a researcher, she was an insider and with her students, it can be said that she was in a power-relationship (Griffith, 1998). The researcher did try to overcome this, especially when the students became aware of the aim of the research during the semi-structured interviews; hence, the interviews and the follow-up questionnaires were implemented after completion of the course and assignment of the final grade. Nevertheless, the concern still existed that the students' answers could be influenced by the grade they had received, whether satisfactory in their eyes or not. The researcher did not have much control over this, apart from the attempt she made at maintaining students' integrity in providing information by explaining the aim of the research and emphasising that it was not her in person that was being tested.

The principal questions posed in research like this are: what influence does the fact that the researcher is an insider have on the course of the research; to what degree can the researcher, in such a case, maintain objectivity and what influence does this have on the research validity? No less important is the question, is objectivity essential in order to maintain research validity (Robson, 2002)?

A concern in connection with the validity of the research was raised earlier in this chapter, with regard to the case study type of research and quasi-experiments of which use was made in the research. In this section, the question of validity is raised in the context of the role of the researcher.

The matter of the role of the researcher can be problematic in the current research, since the paradigm of the research was positivistic, with certain researchers claiming that the key to positivistic research is the presentation of objective information (Crotty, 1998). The claim was that in order to present objective information, the researcher must remain objective (Hammersley, 2000) or, put differently, the researcher must be an outsider. Pure positivistic research does not allow subjectivity on the part of the researcher lest there be a fear of distortion of the real picture. However, in recent years new models have been proposed that have redefined the aims of research, the place of the researcher and the influence that this has on the validity of the research. Hammersley (ibid) claimed that absolute objectivity is not possible and that in all research the researcher's background will influence the objectivity of the information and as a result, according to the strict definition of positivism, it will never be possible to attain validity. Accordingly, new interpretations have emerged in connection with validity. The neo-positivist approach claims that although it is not possible to attain absolute objectivity, one should still aspire to it by conducting research under the most stringent conditions, adopting measures to reduce researcher bias to a minimum (Hammersley and Gomm, 1997). Other post-modernistic researchers have claimed that in reality, a single objective truth is not possible and room must therefore be made for multiple realities (Ellis and Bochner, 2000).

Denzin and Lincoln (2000) as well, attempted to contend with the recognition that it is very difficult or even impossible, to arrive at absolute objectivity, proposing new definitions such as dependability, credibility, transferability and confirmability. The problem of validity is particularly serious when the researcher is an insider (Kvale, 1995), as in the present case. However, researchers who advocate the anti-positivistic approach claim that a researcher who is an insider even has advantages over one who is an outsider, since informants feel more comfortable sharing their feelings and providing more in-depth information when the researcher is a familiar figure. Thus, according to the anti-positivists, it is precisely the researcher as insider, who will succeed in enhancing the validity of the research (Tierney, 1994). According to the anti-positivists, if the research design is transparent and the researchers accurately define their place, their perspective, their likely biases and the manner in which they are handling them, the validity of the research is amplified, since they are providing the readers with all the necessary information, allowing them to derive their own conclusions regarding the manner in which to relate to the research (Cohen, Manion and Morrison, 2000; Hammersley, 2000). In this sense, both positivistic and post positivistic researchers believe that objectivity is not necessarily an advantage with regard to roles of researchers.

Since the researcher in the present case was an insider, an attempt was made to enhance validity through the gathering of data in different ways as described before in this chapter. The questionnaires on cognitive load and task performance can be regarded as more objective data sources, being dependent on the mental effort and performance of each of the students. Because the experiments were carried out as a class exercise that earned the students 2% for their final grade – as marginal a value as this may be – it may be assumed that they did their utmost to attain the maximum results. The very fact that the students were not aware of the aim of the research and that no mention was made of narration with a familiar or unfamiliar voice, lessened the possibility that they would provide more positive feedback with respect to familiar voice, only to please their teacher. This is especially true in light of the fact, that each student heard only one NVSC, i.e. there was no situation calling for a comparison, or one in which students found themselves required to rank one NVSC better than the other, or faced with the dilemma as to whether it would be right from their point of view to rank their teacher lower than an unfamiliar teacher. As far as the students were concerned, the NVSC was given to them for the purpose of self-study, as a natural, integral part of the course. The question of familiarity with the narrator was not raised in any way and the reference in the assessment questionnaire was only to the manner in which the material was presented and the ease of understanding (Appendix L).

In summation, there is no doubt that the role of the researcher as insider and the power relationship with the students could constitute a problem in terms of the validity of the research. However, the research design and the type of data that were gathered were aimed at minimising such interference.

4.8 Research population

The total number of students enrolled in the ***Computer Literacy*** classes, was 481 and all of them were potential participants in the research (see section 4.7 for convenience sampling and the insider researcher). Ninety-nine students (21%) did not participate either because they did not show up for class on the day of the experiment because of personal reasons or because they had previous knowledge of the subject being taught. Out of the remaining 382 who took part in the experiments 10 (3%) completed the assessment questionnaire but did not submit the tasks files.

Following is Table 4-3 , which represents the socio-demographic data of the research population. These data were collected in order to verify that the research population conforms to the descriptions of adult students found in the literature.

As seen in Table 4-3, the research population consisted of 166 (43.5%) female and 216 (56.5%) male students. The average age was 24.5 (median=23, minimum =19, maximum=45). Three hundred and thirty four (87%) students were Israeli natives and 48 (13%) were immigrants, all of whom were considered Israeli Hebrew speakers (more than six years in the country, according to the Academic College regulations). 113 (30%) of the research participants reported holding a full time job, 178 (47%) - a part time job 68 (18%)- not working and 23 (6%)- missing.

Regarding family status: 312 (82%) participants were single, 48 (13%) - married, 19 (5%) – missing. Three hundred and twenty (84%) students were without children, 15 (4%) with one child, 12 (3%) with two children, 15 (4%) with three children and 20 (5%) –missing.

When asked about reasons for missing classes 117 (31%) participants reported missing for work obligations, 107 (28%) for family obligations, 37 (10%) for military reserve duties and 59 (15%) for sickness, 40 (10%) did not miss any class and 22 (6%) missing.

With respect to students with learning difficulties, research shows that video screencasting offers ways to engage students in learning (Gormely and McDermott, 2011). Video screencasting presents information in both audio and visual form, which might help students with learning difficulties (Sylvester and Greenidge, 2009). Moreover, the student control feature of this medium, which allows students to re-run segments of the video, might offer an extra benefit in cases of misunderstanding of a certain detail and thus alleviate cognitive overload. However, for more accurately accommodate technology to a specific learning difficulty, e.g. dyslexia, a careful approach should be taken for matching each student with the appropriate technology (Region10, 2012).

In the college where the present study took place, student learning difficulties data is part of the students' profile in the college database, and students with diagnosed learning difficulty are allowed 25% time extension on tests and class exercises. In the research population of the current study, two students (1% of the study population) had formal documents indicating learning difficulties and thus they were allowed 25% time extension during the experiments. No participant was suffering from a severe visual or hearing difficulty that might interfere with the experiments. Nevertheless, the learning difficulty factor was not explored in the present research.

The data detailed in section 4.8 show that the research population conforms to the non-traditional adult student definitions regarding age, level of occupation, family status, parenting and social obligations (see sections 1.2 and 2.5.1).

Table 4-3: The socio-demographic data of the research population

	Gender		Place of birth		Occupation				Family status			Number of children					Reason for missing classes					
	Female	Male	Israel born	More than six years in the country	Full time	Part time	Unemployed	missing	Single	Married	missing	Without children	One child	Two children	Three children	Missing	Work obligations	Family obligations	Military reserve duties	Sickness	Did not miss any class	Missing
N	166	216	334	48	113	178	68	23	312	48	19	320	15	12	15	20	117	107	37	59	40	22
%	43.5%	56.5%	87%	13%	30%	47%	18%	6%	82%	13%	5%	84%	4%	3%	4%	5%	31%	28%	10%	15%	10%	6%

Age	Average=24.5
	Median=23
	Minimum-19
	Maximum=45

4.9 Research methods

Data were collected using close-ended assessment questionnaires, right after experiencing the NVSC (Appendix L) and a mental effort questionnaire (Appendix I). These data reflected students' mental effort while engaging with the MM learning material presented to them and their perceptions immediately after being exposed to it. After the recall and the transfer tests (Appendices F, G and H) students completed a 9-scale mental effort questionnaire (Appendix J) - one questionnaire for each test. At the end of the experiment, students completed three additional questionnaires relating to conscientiousness, test-anxiety and socio-demographic data (Appendices E and N), see also Figure 4-3. A preliminary analysis of the data suggested issues that were clarified during semi-structured interviews, which later set the basis for a close-ended follow-up questionnaire (Appendix O).

Quantitative data collection tools

4.9.1 Questionnaire for assessment of the NVSCs

The assessment questionnaire (Appendix L) was based on statements expressed by the students on the in-depth interviews during the exploratory research (see Prologue). In addition, the questionnaire was piloted with a group of 25 second-year students as a purposive sample (Shkedi, 2003; Teddlie and Yu, 2007) for clarity and comprehensibility of the questions. These students experienced learning with NVSCs during their first year in college, while participating in the computer literacy course. Thus, they could employ their experience. The students were asked about the questions in the questionnaire and the questions were modified and refined in accordance with their replies.

The aim of the NVSC evaluation questionnaire was to examine the manner in which the students perceived the NVSC that they had viewed. Basing the questionnaire on statements made by other students after experiencing the NVSCs contributed to its content validity. However, before assessing the NVSC the students were asked to complete three preliminary questions: (A) 'were you familiar with the subject matter before you viewed the video recording? Yes/No'; (B) 'choose the most accurate statement regarding your prior experience with the computer: 1-never used, 2-once a month, 3-once a week, 4-almost every day, 5-a few times a day'; (C) 'On a scale of 1 to 6 how would you rate the usefulness of this video to you?_____ 1-not all 6-very useful'. In addition to the fact that all students participating in the course were those who did not pass an exemption test given in the beginning of the academic year, question A was used in order to ensure that all students were novice as far as the subject matter being taught was concerned. It so happened, that three of the students were familiar with the specific subjects chosen for the NVSCs, so they were excluded from the data analysis. Question B aimed to determine the level of previous experience with the computer, so that it could be controlled in the statistical tests. Question C was used in order to assess the validity of the questionnaire by correlating students' score on question C with the average score of the assessment.

The assessment part of the questionnaire contained 22 questions and it was completed by the students immediately after the viewing. The questionnaire contained neutral questions relating to their feeling during the viewing and the manner in which they perceived the effectiveness of the NVSC. The questionnaire did not include directed questions relating to a familiarity with the narrator and the word 'voice' was deliberately not mentioned at all; this was done in order to obtain the students' objective opinion on the viewing of the NVSC without directing any attention to the issue of the voice of the narrator. As mentioned earlier, the students were not aware of the focus of the research

Each question was graded according to a 6-point Likert scale: (1) 'do not agree to a very great extent'; (2) 'do not agree to a great extent'; (3) 'do not agree to some extent'; (4) 'agree to some extent'; (5) 'agree to a great extent'; (6) 'agree to a very great extent' (Appendix L). Usually, a Likert-scale consists of five to seven categories (Likert, 1932) and a 6-point scale was chosen here as a 'forced choice' scale in order to eliminate the middle option of 'Neither agree nor disagree', since a decisive answer was needed (Toner, 1987; Garland, 1991). Although a debate still exists as whether to use an odd or even number of categories (Ory and Wise, 1981; Gable and Wolf, 1993), the 'forced-choice' scale was found to be widely used in various fields such as personality studies (Strelau, et al., 1990), psychiatry (Durieux-Paillard, et al., 2006) and education (Robertson-Wilson, Le´vesque and Holden, 2007). Thus, an even numbered 6-point scale was used for a 'forced-choice' assessment questionnaire. Questions 10, 11, 12, 13, 15, 19, 20, 21, 22 were phrased in an inverse manner in order to prevent response set bias. Reliability was ensured as verbal explanation was given to the students regards the meaning of each point on the 1-6 scale prior to filling the questionnaire.

The NVSC assessment questionnaires (Appendix L) were coded and a reliability analysis showed that question no. 20 (‘The explanations in the recording were presented too slowly for me‘) had low ***Corrected Item-Total Correlation*** (0.11) with the other questions, which means that question no. 20 was not measuring the same thing the rest of the questions were trying to measure. All the other ***Corrected Item-Total Correlations*** ranged from 0.422 to 0.810, thus, question no. 20 was removed from the computation of students’ NVSC-A score. After removing question no. 20, NVSC-A (M=4.96, SD=0.83) yielded 0.92 Cronbach’s α reliability factor. A ***Confirmatory Factor Analysis*** was then performed on the NVSC assessment data using SPSS Amos^{TM} software which showed $\chi2=1333.66$, $p<0.001$, df=189, $\chi2/df=7.06$, RMSEA=0.12. The detailed results of the confirmatory analysis are presented in Figure 4-4:

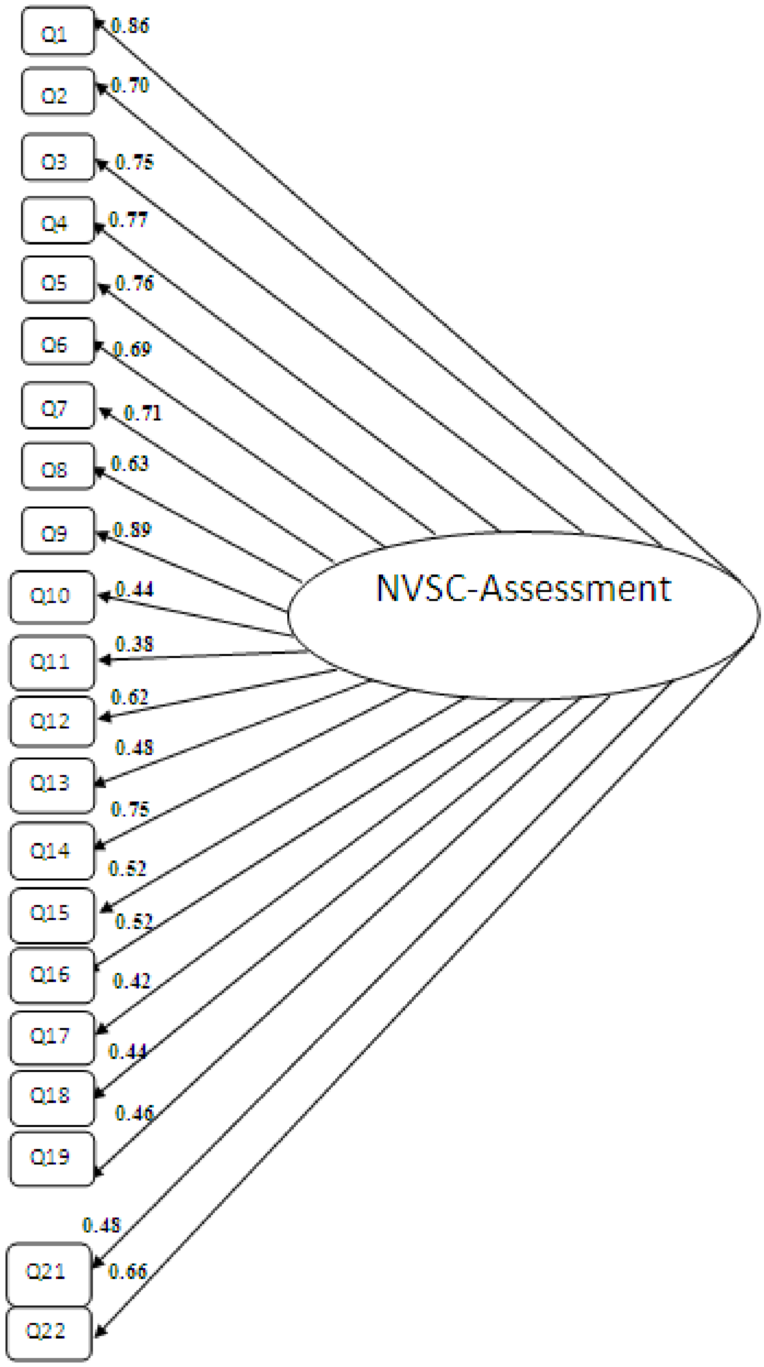

Figure 4-4: Confirmatory factor analysis of the NVSC assessment questionnaire

Figure 4-4 shows that the lambda-ksi estimates, which are analogous to factor loadings in an ***Exploratory Factor Analysis,*** range from 0.38 to 0.89 with the average value of 0.62 (median value=0.63). The indices of $\chi 2$, $\chi 2/df$ and RMSEA test the goodness of fit in this model. The goodness of fit tests assess how well correlations reproduced given the model specified 'match up' with the input set of correlations (Pintrich, 1993). It should be noted, though, that $\chi 2$ was high and significant and $\chi 2/df$ index (=7.06) was too high. According to Hayduk (1987) and Garcia and Pintrich (1996), a good fit between the hypothesised model and the observed data should show a $\chi2$/df index lower than 5, which means that the goodness of fit is not strong enough here. The Root Mean Square Error of Approximation (RMSEA=0.12) was also too high and for a good fit it should have been less than 0.06 (Hu and Bentler, 1999). However, the lambda-ksi estimates indicate large enough factor loading; that is, the questions are fairly consistent with the model and all measure the same thing (Hair, et al., 2007). Thus, for each student one average assessment score (NVSC-A) was computed, representing students' perceived effectiveness of the NVSC. An additional validation test was conducted using question C of the questionnaire ('On a scale of 1 to 6 how would you rate the usefulness of this video to you?_____1-'not all' 6- 'very useful'), which was correlated with the computed score of the NVSC assessment and the correlation was $r=0.803$, $p<0.01$. This correlation shows that the students' answers to the different questions in the questionnaire represented their perception of the effectiveness of the NVSC. Another validity test was performed with correlations between the NVSC-A index and the learning efficiency indices and as can be seen in Table 5-1 this index correlated very highly ($p<0.01$) with all the learning efficiency indices, i.e. LPE-Rec, LPE-Trn, TE-Rec, TE-Trn, 3D-E-Rec and 3DE-Trn.

4.9.2 Measurement of task performance

Evaluation of students' assignments is intended to check their command of the material learned. A distinction exists between formative assessment – an evaluation that is given to the students during the course of learning, following which they are expected to study and improve – and summative assessment, given only on completion of studies. The evaluation used in this research is summative, intended to examine the extent to which the students achieved the study goal with the help of NVSC (Hammond and Collins, 1991; Yorke, 2003). For the purpose of this evaluation, rubrics were developed by the researcher, which detailed the skills the students were expected to display and the points awarded them for performance on different levels.

An evaluation rubric is a grading tool in table format that states the criteria according to which the student's assignment is evaluated, based on different standards of performance (Andrade, Du and Mycek, 2010; Reddy and Andrade, 2010). The criteria describe the components of the assignment that the students were supposed to carry out. The standards are detailed according to performance level for each of the criteria, from lowest to highest, including a breakdown as to the intention in each of the standards with respect to each of the criteria and the grade assigned to each one of them. A detailed assessment rubric raises the accountability of the evaluator, since according to Jonsson and Svingby (2007), the use of assessment rubrics raises consistency in assignment of grades.

The students' tests (Appendices F, G or H) were checked by an objective examiner proficient in the subject matter. The examiner was not aware of the purpose of the experiment, nor was he aware that the students were viewing the NVSCs with differing narration. The examiner graded the students' examinations according to a detailed grading rubric (Appendices P, Q or R respectively). All of the tasks files were checked by the same examiner in order to prevent a possible skew between different examiners. A separate grade was given for the recall test and the transfer test, i.e. for each student two grades were calculated, on a scale of 100% each. Students who did not participate in the experiment, for whatever reason, were given an opportunity to perform a home exercise that was not included in the data gathered for the research.

An analysis of inter-observer agreement was performed to assess the tasks' assessments. As stated above, only one person assessed the tasks' files, using detailed rubrics (Appendices P, Q and R) but in order to judge the consistency of the assessment, 30 students were randomly selected and reassessed by the same person for both recall and transfer test. A correlation test resulted in recall test ($r=0.997$, $p<0.001$) and transfer test ($r=0.992$, $p<0.001$), which means that the assessor was consistent in his judgments.

4.9.3 Mental effort questionnaire

The one-item self-report mental effort questionnaire (Appendices I and J) was developed by Paas (1992) for measuring mental effort experienced by the student either during learning or during task performance. Although, this single-item questionnaire has been criticised (de Jong, 2010), Yeo and Neal (2008) show that unambiguous constructs like perceived mental effort can be measured by a one-item measuring tool. The developer of the questionnaire reported reliability of Cronbach's $\alpha=0.90$ (Paas, 1992) and other research papers show that it is sensitive enough to detect small changes in mental effort (Paas, Van Merriënboer and Adam, 1994; Van Gerven, Paas, Van Merriënboer and Schmidt, 2004). As explained in section 3.1.3, this questionnaire was selected from among other cognitive load measuring tools for being non-intrusive and reliable. The wording in the questionnaires used in this study was related to either the mental effort during learning (Appendix I) or the mental effort during task performance (Appendix J) and the students were requested to rate their mental effort on a 1 to 9 Likert scale. The questionnaire was piloted among computer course students from a different class. Moreover, the results of the tasks assessments and the corresponding cognitive load show that in the recall task, students reported a lower mental effort (cognitive load) than in the more difficult transfer task (see Table 5-2 and Table 5-3, respectively), which may indicate that the students understood what mental effort is.

In order to analyse the reliability of the one-question mental effort questionnaire the three mental effort scores, i.e. mental effort on learning (M=4.796, SD=1.840), mental effort on recall task (M=5.040, SD=1.968) and mental effort on transfer task (M=6.134, SD=1.948), were compared and yielded Cronbach's α=0.761.

4.9.4 Learning efficiency calculations

Test Performance was measured as described before, where each student received two grades: one for the recall task and one for the transfer task. Mental effort (representing cognitive load) was measured by questionnaires (Appendices I and J) proposed by Paas (1992) as described in section 3.1.3. Calculations for learning process efficiency (LPE), task efficiency (TE), three-dimensional learning efficiency (3D-E) and motivation on task (MT), were carried out using the formulas proposed by Tuovinen and Paas (2004), Paas, et al. (2005) and van Gog and Paas (2008), see section 3.1.4. These equations were found to be the most appropriate for this research (see Equation 3-1, Equation 3-2, Equation 3-3 and Equation 3-4). The equations serve as diagnostic tools to differentiate between the efficiency of various instructional designs.

4.9.5 Individual differences questionnaires

Numerous tools exist for measuring personality traits and motivational variables. In this research, use was made of the following tools:

- ***Neuroticism-Extroversion-Openness Five Factor Inventory*** (NEO-FFI) (Costa and McCrae, 1992a), for measurement of **conscientiousness**. **Conscientiousness** is one of the ***Big Five*** personality traits model, which is considered the most common model for measuring personality traits. The relevant questions for research can be extracted from the model – in the case of this research, 12 questions relating to **conscientiousness** (Appendix N).

- ***Motivated Strategies for Learning Questionnaire*** (MSLQ) (Pintrich, et al., 1991), for measurement of **test-anxiety**. This tool was found to be suitable for use here, since it was developed for college students and is constructed from modules that are stand-alone. It is, thus, easily possible to choose one particular module according to the research needs. In this study, use was made of the five questions related to test-anxiety (Appendix E).

4.9.5.1 Measuring conscientiousness-NEO-FFI questionnaire

The NEO-FFI questionnaire (Costa and McCrae, 1992a) that was used in this research is the authorised NEO-FFI questionnaire that was translated into Hebrew and the researcher received approval to use the official Hebrew questionnaire in her research. The questionnaire is an abbreviated one and contains 60 items, 12 for each of the five model variables (the full questionnaire contains 243 items). For each of the items the participants express agreement or disagreement on a 5-point Likert scale, ranging from (1)'do not agree at all' to (5) 'fully agree'. Half of the items in each of the variables are worded positively and the other half negatively. The abbreviated model measures five personality traits (**conscientiousness**, agreeableness, openness, extraversion, neuroticism). It is a questionnaire that is widely used and has good reliability, internal consistency and validity. Reliability indexes reported by its developers ranged between 0.75 and 0.83.

In the current research, use was made of **conscientiousness** related questions only, as this trait was found to be the most suited to an examination of the research variables. The **conscientiousness** questionnaire is reported by its developers as Cronbach's α=0.83 (Costa and McCrae, 1992a). The Hebrew version was reported by its translator as Cronbach's α=0.81 (Obtained from B.I.P- Institute of Psychology LTD, the authorised owner of the Hebrew version copyrights). In this research, **conscientiousness** questionnaire yielded M=3.84, SD=0.54, Cronbach's α=0.792.

4.9.5.2 Measuring test-anxiety – MSLQ

The MSLQ is a measuring tool for self-reporting that is meant to evaluate the motivational orientation of the student from the cognitive point of view (McKeachie, et al., 1986; Pintrich and de Groot, 1990). The questionnaire is based on a general cognitive perspective of motivation and learning strategies. The complete questionnaire contains 81 questions, of which 31 are related to motivational variables and 50 to learning strategies. The section dealing with motivation is divided into sub-categories: intrinsic motivation, extrinsic motivation, control over learning, task value, self-efficacy and **test-anxiety**. The MSLQ was constructed for college students and since this is the population of this research, it was found to be suitable for use as a measuring tool here.

The measuring scales included in the MSLQ questionnaire can be used both together and separately. They were designed modularly so that the modules can be selected according to the research needs. The questionnaire was designed for use in the class, with the students evaluating themselves on a 7-point Likert scale, from (1) ' not at all true of me' to (7)' very true of me' (Pintrich, et al., 1991). With respect to each module, the mean of the students' answers is calculated in order to determine their grade in that module. Previous researches that used this questionnaire reported on Cronbach's α in a range from 0.52 to 0.93 for the various modules of the questionnaire, with test-anxiety, which is of interest in the present research, showing 0.80 on Cronbach's α (Duncan and McKeachie, 2005).

The questionnaire is intended for evaluation of the variables regarding a specific course, the assumption being that the students' answers could differ for different courses. The category that was selected for the purpose of the research was that dealing with **test-anxiety**, located in the motivational section of the questionnaire and defined as an affective component of motivation (Pintrich, et al., 1991).

The questionnaire was translated into Hebrew with the permission of its authors (Birenbaum, 1995) and the Cronbach's α coefficients of the Hebrew version were found to be very similar to those reported by its developers. The relevant five questions related to test-anxiety of the Hebrew version yielded Cronbach's $\alpha = 0.72$ (Hativa and Birenbaum, 2000). In this study, **test-anxiety** questionnaire yielded $M=3.97$, $SD=1.20$, Cronbach's $\alpha=0.771$.

4.9.6 Socio-demographic questionnaire

The socio-demographic questionnaire (Appendix E second part) was used in order to obtain data relating to the profile of the research population namely, age, gender, place of birth, occupation, family status, number of children, reasons for missing classes and matriculation examination score. Data relating to age, gender and Matriculation examination score, in addition to the computer experience score (Appendix L, question B), were tested for correlation with the dependent variables and were used as covariates in the statistical analysis, when correlation was found (see section 4.4.1). The rest of the data was used in order to demonstrate the conformity of the research population to the adult student definitions, as explained in section 2.4.1 and demonstrated in Table 4-3.

Qualitative corroborative data collection tool

4.9.7 Semi-structured interviews

The interview is the most common data collection method used in qualitative research (Cohen, Manion and Morrison, 2000; Bryman, 2001; Creswell, 2007) and in the present study it constituted the qualitative part of the mixed methods research. The research literature refers to different types of interviews and there is no consensus regarding the number of types or their nature. According to Cohen, Manion and Morrison (2000, p.270), these factors depend on whose article one reads. According to Kvale (1996), interviews can be defined according to their degree of openness, structure, purpose, cognitive or emotional focus, etc. Bryman (2001, p.110) summarises the main types of interviews that appear in different research articles:

- The ***structured interview***, or as referred to by Bryman, the ***standardised interview***. In such an interview, all interviewees receive the same questions. The interviewer is not allowed to change the wording or order of the questions, while it is also desirable that he/she be the same in all cases. Generally, the questions are close ended, i.e. the interviewee is given a choice of alternatives from which to choose. This type of interview is used by quantitative researchers but not in qualitative research, since they do not allow probing for additional relevant information;
- The ***semi-structured interview***. An interview of this type covers a wide range of possibilities. The questions, prepared in advance by the interviewer, are general. Additional questions can be added in accordance with the answers obtained from the interviewee and the order of the questions can be changed;

- The ***unstructured interview***, also known as the ***intensive interview***. The interviewer has only a list of subjects that interest him/her and no prepared questions. The interview is informal and depends on the interaction with the interviewee. It resembles more a conversation between the interviewer and interviewee;
- The ***qualitative interview***. This general term refers to semi-structured and unstructured interviews;
- ***In-depth interview***. Like the ***qualitative interview***, the ***in-depth interview*** refers at times to the ***unstructured interview*** but more often to the ***unstructured interview,*** as well as to the ***structured interview***;
- ***Focused interview***. This term refers to an interview in which there are mostly open questions that relate to a specific event of relevance;
- ***Focus group***. This is similar to the focused interview, except that it takes place with a number of interviewees;
- ***Group interview***. Some regard this as a synonym for the focus group, but others state that in the group interview the interviewees can talk about a number of subjects that are not necessarily interconnected;
- ***Oral history interview***. This interview can be unstructured or semi-structured, in which the interviewee is requested to reflect on specific events in his/her past;
- ***Life history interview***. This interview is identical to the oral history interview but the aim in this case is to gather information on the entire biography of each of the interviewees;

The main types of interviews used in qualitative research are the ***unstructured interview*** and the ***semi-structured interview***. These are flexible, with the interviewer also wishing to hear the opinion of the interviewee. The interviewee is allowed to deviate from the subject, while the interviewer is allowed to ask questions that were not prepared in advance, in accordance with the topics raised during the course of the interview (Bryman, ibid).

In this research, the interviews were ***semi-structured***. During the exploratory phase of the research (see Prologue), in-depth interviews were conducted in which, students could speak freely on any issue related to their experience with the course material, with the majority of the students preferring the NVSCs. The issue of hearing the class instructor's voice was mentioned by many of the students, some of them referring to the familiar voice as a necessary feature of the NVSC and some students were indifferent to the voice familiarity. In light of the issues that were brought up in the ***in-depth interviews***, the researcher prepared a list of questions to be asked during the semi-structured interviews phase of the study. Contributing to these questions, in addition, were informal comments that were voiced by the students after their experience in the classroom with NVSC and which were indicated for clarification during the interview stage. Preliminary questions were prepared ahead of the interview (see interview guide Appendix S). However, in the course of the interview, additional questions were asked in accordance with the suggestion of Kvale (1996), who proposed additional types of questions that were worth including in every interview in order to obtain additional information.

All the participants who attended the quasi experiments (382) were invited to the interviews by e-mail. Thirty-seven students (10%) gave their consent to be interviewed at their convenience and they chose to do that in accordance with their examination schedule. The general atmosphere during the interviews was a kind of 'consultation' with the students of how to improve MM learning material. It was surprising how enthusiastic those who came to the interviews were, to cooperate and contribute from their experience. They felt they were being helpful in advancing educational technology integration for future students in the college. Following Kvale (1996), at the beginning of the interview *introducing questions* were asked, e.g. 'How was the course'? 'How was the exam'?; 'Was the material difficult'? During the course of the interview, *follow-up questions* were asked, e.g. 'What do you mean by saying - it ruined your concentration'?; 'What exactly did you feel when you heard a familiar/unfamiliar voice'?; 'Did it really bother you that the voice was unfamiliar'?; 'But I was the one who gave you the recording – why did it bother you'?; 'What bothered you in the fact that the voice was unfamiliar'?; 'What did you imagine when you heard the narration'? Examples of *probing questions* – 'If the voice had been unfamiliar, would it have bothered you'?; 'If the voice had belonged to a professional narrator, would it have been better'? and an example of a *specifying question* – 'Did you have to hear the recording over more than once'? There were also *direct questions* – 'Do you think it is crucial that each instructor create NVSCs for his/her students'? An example of an *interpreting question* – 'Would it be OK if the course was structured on the basis of similar recordings from different sources downloaded from the Internet'? In general, the interviewees were enthusiastic about the whole idea of using

NVSCs as auxiliary learning material in the course. They were only divided in regards their preferences for a familiar narrator. There was only one surprising statement made by a student, who said that not only did she prefer an unfamiliar voice, in her opinion, NVSCs with a different narrator for each recording could have helped her remember the material better by allocating each voice to a specific subject. This statement was in line with the ***orienting response theory*** (Sokolov and Cacioppo, 1997). However, only one student mentioned it.

In this study, the semi-structured interviews, conducted after the experimental phase had ended, were intended to examine together with the students, whether the question of familiarity with the narrator was an issue at all, since it was entirely possible, that they did not feel that thought should be given to the subject or that it was potentially disturbing. The interviews were recorded with the students' consent as part of the research they agreed to take part in, when signing the consent forms (Appendix M).

Using semi-structured interviews with students, after preliminary analysing the quantitative data, added more aspects and new dimensions to the way students perceive MM learning material, in general and to their attitude experiencing material narrated by an unfamiliar instructor in particular. Qualitative data collected during the semi-structured interviews set the basis for a close-ended follow-up questionnaire. It also helped test the consistency of the data collected during the experiments.

Each interview lasted 15-20 minutes and the recorded interviews were transcribed by impartial professional transcribers (Appendix T). Then, a content analysis was performed, based on a derivation of categories (see section 4.11.2). The statements constructed, based on the transcribed interviews served for the preparation of a follow-up questionnaire (Appendix O).

Quantitative corroborative data collection tool

4.9.8 Close-ended follow-up questionnaire

The purpose of the follow-up questionnaire (Appendix O) was to obtain students' preferences related to the familiarity with the narrator. The aim of the questionnaire was to inform the students of the real purpose of the study and get their preferences regarding the familiarity with the narrator a few weeks after experiencing with the NVSC. It was assumed that when the questionnaire was completed not immediately after the experience with the NVSC, the students would relate their preference more objectively with a minimum correlation to the level of ease or difficulty they experienced during the experiment. The follow-up questionnaire was handed out to the students in their classes at the beginning of the second semester, when they were no longer studying ***Computer Literacy***. Thus, the questionnaire was also completed by students who did not take part in the experiments. However, for data analysis, only those who participated in the experiments were taken into consideration. The questionnaire served to obtain additional information from the students who participated in the research and who were not interviewed. Question no. 1 of the questionnaire was further tested statistically in order to see if there was a connection between students' preferences and the results related to the influence of the various NVSCs. Questions no. 2 and no. 3 were analysed to attain a deeper insight into students' perception of a familiar and unfamiliar narrator (see section 5.3). The questions in the follow-up questionnaire were based on the statements that were derived from the interviews and were intended to obtain supplementary information from additional students who did not take part in the interviews. Among the students who completed the questionnaire were also the 37 students who were interviewed.

4.10 A summary of the data collection tools which were used in this study

4.10.1 Quantitative data collection

- Closed-ended assessment questionnaire (Appendix L);
- Mental effort questionnaire for the MM learning phase (Appendix I);
- Recall and transfer Tests (Appendices F, G or H);
- Mental effort questionnaires for recall test phase (Appendix J);
- Mental effort questionnaires for transfer test phase (Appendix J);
- Conscientiousness questionnaire (Appendix N);
- Test-anxiety questionnaire (Appendix E);
- Socio-demographic data (Appendix E second part);

4.10.2 Qualitative data collected for corroboration

- Thirty seven semi-structured interviews (Appendix T- two sample interviews);

4.10.3 Quantitative data collected for corroboration

- Follow-up questionnaire, based on the statements extracted from the interviews (Appendix O);

4. 11 Data analysis tools

4.11.1 Statistical analysis

The following statistical analyses were carried out on quantitative data collected from questionnaires, test performance and follow-up questionnaires using SPSS^{TM} (Statistical Package for the Social Sciences) for Windows, a widely used software for statistical analyses in the social science research (Bryman, 2001). The version used here was SPSS 13.

A. ***Reliability analysis*****-**for **mental-effort**, **conscientiousness** and **test-anxiety questionnaires**

Cronbach's α: This is a model of internal consistency, based on the average correlation between items (Cronbach, 1951). In this study, it was used in order to judge the consistency of the **mental-effort**, **conscientiousness** and **test-anxiety questionnaires** (Appendices I, J, N and E) and the consistency of the students' test files assessment by the outside examiner.

B. ***Confirmatory Factor Analysis*****-** for the **NVSC assessment questionnaire**

The primary objective of this analysis is to determine the ability of a predefined factor model to fit an observed set of data. In this study, it was used in order to establish the validity of the **NVSC assessment questionnaire** (Appendix L) as a single factor model.

C. ***General statistics***

- ***Bivariate Correlations*****- between the dependent and independent variables**

This procedure measures how the variables in the study are related. It computes Pearson's correlation coefficient, with its significance levels. In this study, Bivariate Correlations test was used to test the **correlations between the dependent and independent variables.**

- ***Descriptive statistics*** of **dependent and independent variables**

Descriptive statistics quantitatively describe the main features of the data. In this research, the descriptive statistics were used to exhibit the **sums, means, standard deviations and frequencies of the dependent and independent variables**.

D. Multivariate tests

- ***Multivariate analysis of covariance*** **(MANCOVA)- testing the influence of voice familiarity and interaction of voice familiarity and gender similarity**

This test is used for testing the effects of one or more factor variables or covariates on the means of multiple dependent variables. It also allows investigating interactions between factors. In the present research, MANCOVA was conducted in order to test the **influence of voice familiarity** and the **influence of the interaction of voice familiarity and gender similarity** on the learning indices in recall and transfer tests, with age and prior computer experience as covariates.

- ***Tests of between subjects effects* -** for **recall and transfer test**

In this test, the population is divided into groups. Thus, it allows investigating interactions between factors, as well as the effects of individual factors. In the present study, this test was conducted whenever the MANCOVA results were found to be significant in order to test the **recall and transfer test separately**.

- ***Bonferroni post hoc test for pairwise comparisons- for*** **voice familiarity and gender similarity**

This test is used when there are multiple comparisons, which exhibit statistical significance. Once it is found that significant differences exist among the means, post hoc range tests and pairwise multiple comparisons test is performed for each dependent variable separately in order to determine which means differ. In the present study, this test was used whenever a significant difference was found in order to test the **results in relation to voice familiarity and gender similarity**.

E. ***Univariate analysis of covariance*** **(ANCOVA)- testing the assessment of the NVSCs** (NVSC-A),

This test is used for testing the effects of one or more factor variables or covariates on the means of a dependent variable. It also allows investigating interactions between factors. In this research ANCOVA was conducted in order to test the **influence of voice familiarity and gender similarity on the assessment of the NVSCs** (NVSC-A), with age and prior computer experience as covariates.

F. Simple Frequency analysis**-** for **question no.1 of the follow-up questionnaire**

The frequency analysis produces frequency counts and percentages of the values of individual variables. In this study, this procedure was used for calculating the

frequencies of the responses for question no.1 of the follow-up questionnaire (Appendix O).

G. ***Frequencies for Multiple response*** **–** for **questions no. 2 and no. 3 of the follow-up questionnaire**

   The Multiple Response Frequencies procedure produces frequency tables for multiple response sets. In the current study, this procedure was used for calculating the **frequency of the multiple responses in questions no. 2 and no. 3 of the follow-up questionnaire** (Appendix O).

H. ***Independent samples T-test- to compare learning indices according to students' preferences***

   This procedure compares means for two groups of cases on a given variable. In the present research, this procedure was conducted in order to **compare the means of the learning indices between the group of students who preferred a familiar narrator and the group who had no preference**, as they indicated in question no. 1 of the follow-up questionnaire.

I. ***Levene's Test of Equality of Error Variances*****- for testing the homogeneity of the population**

   Since one of the MANCOVA's assumptions is the homogeneity of the population, this test is used to test whether the population variances are equal. In this study, the **homogeneity of the population** was tested in relation to the learning indices and NVSCs assessments.

4.11.2 Content analysis- for the transcribed semi-structured interviews

This research used content analysis as a method for analysing the semi-structured interviews. Content analysis is a method by which texts are studied in order to reveal deeper meaning underlying the text. It relies on a technique using rules of coding for creating content categories. Thus, it enables researchers to handle large volumes of data (data may be text, pictures or videos) (Shkedi, 2003). In this study, content categories were used while analysing the semi-structured interviews.

The semi-structured interviews were transcribed and divided into categories in order to identify and amalgamate the subjects that were raised in them. This division followed a stage-by-stage method (Lincolnand and Guba, 1985; Burnard, 1991; Miles and Huberman, 1994; Kacen and Krumer-Nevo, 2010). The stages were:

- holistic reading of the data
- organising and minimising the data
- breaking the data into smaller units of analysis
- re-constructing the data and conceptualising
- holistic re-reading of the data
- verifying the data
- writing (Kacen and Krumer-Nevo, ibid, pp. 4-6)

Although suggestions have been made to allow coding of interviews to be done by a number of people (Cohen and Crabtree 2008), in the case of this research, coding was done by the researcher alone, since the interviews were short, semi-structured and focused and most of the subjects raised related directly to the research questions. Thus, coding was not problematic while there were not too many possibilities for interpretation (Koch, 2006). In addition, as stated earlier, the interviews were not used to derive conclusions but served rather as a basis for structuring a questionnaire to gather supplementary date for corroboration.

4.11.3 Power analysis

In the present study a *post hoc* statistical power analysis was conducted with G*Power, which is a power analysis program for statistical tests commonly used in social and behavioural research (Faul et al., 2007). The analysis was based on 382 observations, 15 variables (9 dependent variables, 4 independent variables, and 2 covariates), and level of significance α=0.05. It was found that the research design was able to detect significant effects from a size of $\eta 2$=0.05 with a high statistical power of (1-β) =0.99. This indicates a low probability for a type II error.

Significance tests that lack statistical power cannot reliably discriminate between H_0 and the alternative hypothesis H_1. A type I error occurs when one rejects the null hypothesis H_0 when it is true, and its probability is α. Type II error occurs when one rejects the alternative hypothesis H_1 (fails to reject the null hypothesis) when the alternative hypothesis is true, and its probability is β. As the statistical power $1-\beta$ increases the probability of Type II error decrease. Conventional values of α and β are 0.05 and 0.20, respectively (Cohen, 1988).

Using *a priori* power analysis in the research planning can control statistical power by computing the sample size (Hager, 2006). It is conducted whenever resources required for data collection are not critical (Faul et al., 2007). In the *post hoc* power analysis, as was used in the present study, the statistical power $1-\beta$ is computed after the study is completed (Faul et al., 2007). The *post hoc* power analysis enables the assessment of whether or not a published statistical test in fact, had a fair chance of rejecting an incorrect H_0 and thus is appropriate for future related studies. As shown above, the power analysis of the present study indicates a low probability for this kind of error.

4.12 Ethical aspects

4.12.1 Concerns that had to be taken into consideration

- It was assumed that some students would not be comfortable with the headset and thus, feel frustrated. In addition, it was assumed that some students would not understand the MM instructions for various reasons including those being manipulated in the experiment, i.e. type of narration;
- Assessment and questionnaire completion were carried out during the class session, so a supplementary lesson was offered to all the groups right before the examination;
- Being both the teacher and the researcher of some of the students, the researcher had to address her role as researcher with greater assiduity;
- It was assumed that students, unhappy with MM learning, would complain about that and that might be reflected in the researcher's annual assessment. In order to minimise that risk students were assured that material covered in the NVSCs would be revised and explained again in class immediately after the experiment or in the following class and that was explained to them in the Student Information Sheet (Appendix K);
- In case familiarity with the narrator does indeed have some influence then students who received NVSC of other narrators were adversely affected; on the other hand, if there is an advantage to an unfamiliar voice then students who received NVSC with a familiar voice were adversely affected. Accordingly, irrespective of the type of

NVSC with which they studied, the material that was learned through the NVSC was revised in the frontal lesson following the class exercise;

4.12.2 Action taken to avoid possible ethical faults

- To compensate for any possible interruption in learning and possible difficulties in understanding the subject included in the MM learning material, that same subject was taught and revised in class;
- Semi-structured interviews were conducted only after the examinations and grading;
- Students were assured that their feedback would not affect their grades in any way (Appendices K and M);
- Students were assured that performance in the research tests would not lower their final grade and in case they failed the experiments' test they would get an alternative exercise;
- Students who wished to withdraw from the research were given an alternative home exercise;
- Students' names did not appear on any piece of data collected to preserve their anonymity;
- Interview audio files were saved under false names;
- The only information that identified the data collected was students' ID numbers, in order to enable matching together data belonging to the same participant while still maintaining anonymity as far as possible;
- There was no identification of the institution and the location of the institution;
- Students' personal data were kept confidential;
- Students were not aware of the research aim and focus, although they were informed that the data collected would be used for research for learning improvement. However, during the interviews and later on in the follow-up questionnaires they were notified of the research focus;
- All ethical concerns were explained to the students in terms of ensuring them that all measures would be taken to avoid any interruption to their studies and that they were all free to withdraw from the research with no consequences (Appendices K and M);
- By the fact that the research was conducted within a group of the researcher's students, this situation entailed a certain level of power relations. However, the

students were given the option of not participating in the research. Evidently, the students provided their informed consent to participate and were given the opportunity to withdraw from the research at any time. This way power relation was minimised and bias was minimised accordingly;

Chapter 5 - Findings

This chapter will present the findings of the research. The chapter considers data collection and preparation, the results of the research and the results from corroborative data collected for the sake of shedding more light on the findings. In addition, this chapter deals with the limitations of the results. The findings in section 5.1.3, 5.1.4, 5.1.5 and 5.1.6 are presented according to the research hypotheses (see sections 3.7, 3.8, 3.10 and 3.11). For testing the research hypotheses quantitative tools were used as detailed in section 4.9. A qualitative tool (semi-structured interviews) was used for setting up a follow up questionnaire for the corroborative data (see sections 4.9.7 and 4.9.8) and the corroborative findings are detailed in sections 5.2, 5.3.

This research aimed to reveal whether there is any influence caused by the familiarity of students with the narrator. The research sought an answer to the question of whether there is a difference in both the perceived and actual effectiveness of the learning materials featuring familiar or unfamiliar voice and whether individual differences exhibited by **conscientiousness** and **test-anxiety** have any influence in the matter. In addition, in the light of *similarity attraction effect*, the research tried to find out whether there is an interaction of gender similarity between student and narrator and voice familiarity.

5.1 Quantitative findings

5.1.1 General statistics

Table 5-1, which follows, describes the means and correlations of the three efficiency indices: learning process efficiency (LPE), task efficiency (TE), three-dimensional learning efficiency (3D-E) and motivation on task (MT) in recall (Rec) test and transfer (Trn) test. The indices were calculated according to the formulas suggested by Paas and van Merriënboer (1993) and which were revisited and elaborated by other researches (Tuovinen and Paas, 2004; Paas, et al., 2005; van Gog and Paas, 2008), see Equations 3-1, 3-2, 3-3 and 3-4. As seen in Table 5-1, there is significant correlation between the dependent variables, which imply that they are all part of the same conceptual domain. Hence, the MANCOVA test was found to be a proper test in this research. The controlling variables were selected in the light of the correlation results, i.e. gender and previous computer experience, which were found to be correlated with the dependent variables.

Table 5-1: Correlations between the variables in the study

N=372	M	S.D.	LPE-Trn	TE-Rec	TE-Trn	3D-E-Rec	3D-E-Trn	MT-Rec	MT-Trn	NVSC-A	Age	Matriculation score	Gender	Computer experience	Conscientiousness	Test anxiety
LPE-Rec	-0.0014	1.25	0.936**	0.846**	0.698**	0.955**	0.876**	0.276**	0.250**	0.278**	0.033	0.058	-0.010	0.141**	0.025	-0.229**
LPE-Trn	-0.0014	1.22		0.781**	0.783**	0.899**	0.927**	0.201**	0.367**	0.288**	0.039	0.035	-0.046	0.142**	0.003	-0.240**
TE-Rec	0.0000	1.288			0.806**	0.948**	0.827**	0.000	0.144**	0.243**	-0.075	0.018	-0.053	0.153**	0.106*	-0.198**
TE-Trn	0.0036	1.19				0.775**	0.930**	-0.004	-0.004	0.231**	-0.065	-0.023	-0.144**	0.171**	0.099	-0.244**
3D-E-Rec	-0.0012	1.47					0.902**	0.030	0.145**	0.277**	-0.013	0.043	-0.058	0.147**	0.070	-0.228**
3D-E-Trn	0.0036	1.36						0.027	0.042	0.278**	-0.003	0.015	-0.123*	0.163**	0.064	-0.266**
MT-Rec	0.0000	0.58							0.500**	0.021	0.058	0.026	0.197**	0.038	-0.092	-0.016
MT-Trn	0.0036	0.748								0.074	0.032	0.005	0.184**	0.008	-0.127*	0.026
NVSC-A	4.496	0.823									0.038	-0.017	-0.079	0.141**	0.077	-0.218**
Age	24.544	4.67										0.083	-0.095	-0.039	-0.040	-0.243**
Matriculation score	92.473	42.42											0.004	0.057	0.046	-0.035
Gender	____	____												-0.066	0.014	0.143**
Computer experience	4.2565	0.99													0.023	-0.208**
Conscientiousness	3.84	0.541														-0.148**
Test-anxiety	3.97	1.20														

*P<0.05, **P<0.01 (2-tailed)

The SPSS output of the MANCOVA statistics analyses appears in Appendix U

For testing the research hypotheses two independent variables were constructed:

1. ***Voice-familiarity*** which categorised the different narrations into two categories:
    - A familiar narrator;
    - An unfamiliar narrator;
2. ***Voice-familiarity and gender-similarity***- which categorised the different narrations into four categories:
    - A familiar voice of the same gender as the student's;
    - A familiar voice of the opposite gender;
    - An unfamiliar voice of the same gender as the student's ;
    - An unfamiliar voice of the opposite gender;

Two more independent variables were conscientiousness and test-anxiety.
The dependent variables were:

- Learning Process Efficiency in recall (LPE-Rec) and transfer test (LPE-Trn);
- Task Efficiency in recall (TE-Rec) and transfer test (TE-Trn);
- Three-dimensional Learning Efficiency in recall (3D-E-Rec) and transfer test (3D-E-Trn);
- Motivation on Task in recall (MT-Rec) and transfer test (MT-Trn);
- Narrated Video Screen Capture assessment (NVSC-A);

The control variables, which were found to be correlated with the dependent variables, were ***Gender*** and ***previous experience with the computer*** (see section 4.4.1). The other variables that were tested as potential control variables, in accordance with existing research literature were insignificantly correlated with the dependent variables (Section 4.4.1). For correlations and significance, see Table 5-1**.**

Appendix V describes the MANCOVA F-statistics and significance of the four indices:

- Learning process efficiency (LPE);
- Task efficiency (TE);
- Three-dimensional learning efficiency (3D-E);
- Motivation on task (MT);

Tables 5-2 and 5-3 exhibit the descriptive statistics of these variables in relation to two instructional conditions: NVSC with a narrator known to the student (class instructor) and with an unfamiliar narrator. Table 5-2 represents the raw and marginal means of the three learning indices and motivation in the recall test, while Table 5-3 represents the raw and marginal means of the three learning indices and motivation in the transfer test. Also included in Table 5-2 and 5-3 are the cognitive load and performance scores which were used for the calculations of the efficiency indices.

Table 5-2: Voice familiarity and gender similarity- descriptive statistics of means and marginal means for the recall Test

			N	Cognitive load-learning phase (SD)	Task-Cognitive load (SD)	Task-score (SD)	LPE (SE)	TE (SE)	3-DE (SE)	MT (SE)
Recall Task	Familiar voice	Same gender	99	4.263 (1.877)	4.737 (1.827)	81.283 (12.980)	0.260 (0.119)	0.215 (0.125)	0.325 (0.139)	-0.024 (0.058)
		Different gender	73	4.233 (1.752)	4.562 (1.764)	80.973 (13.866)	0.345 (0.140)	0.267 (0.146)	0.407 (0.163)	-0.037 (0.067)
		Total	172	4.250 (1.820)	4.663 (1.797)	81.151 (13.325)	0.303 (0.091)	0.241 (0.095)	0.366 (0.106)	-0.031 (0.044
	Unfamiliar voice	Same gender	94	4.745 (1.722)	4.840 (2.132)	79.287 (17.50)	0.044 (0.122)	0.098 (0.127)	0.106 (0.142)	-0.072 (0.059)
		Different gender	106	5.726 (1.607)	5.830 (1.869)	75.538 (16.417)	-0.493 (0.114)	-0.422 (0.119)	-0.627 (0.133)	0.129 (0.055)
		Total	200	5.265 (1.729)	5.365 (2.053)	77.300 (16.999)	-0.224 (0.084)	-0.162 (0.087)	-0.261 (0.097)	0.029 (0.040)
	Total	Same gender	193	4.497 (1.815)	4.788 (1.977)	80.311 (15.345)	0.152 (0.086)	0.156 (0.090)	0.215 (0.100)	-0.048 (0.041)
		Different gender	179	5.117 (1.818)	5.313 (1.926)	77.754 (15.618)	-0.074 (0.090)	-0.078 (0.094)	-0.110 (0.105)	0.046 (0.043)
		Total	372	4.796 (1.840)	5.040 (1.968)	79.081 (15.509)				

Table 5-3: Voice familiarity and gender similarity- descriptive statistics of means and marginal means for the transfer Test

			N	Cognitive load-learning phase $^{(SD)}$	Task-Cognitive load $^{(SD)}$	Task-score $^{(SD)}$	LPE $^{(SE)}$	TE $^{(SE)}$	3D-E$^{(SE)}$	MT $^{(SE)}$
Transfer Task	Familiar voice	Same gender	99	4.263 $^{(1.877)}$	5.949 $^{(1.892)}$	79.081 (13.880)	0.287 (0.115)	0.206 (0.117)	0.318 $^{(0.130)}$	0.048 (0.074)
		Different gender	73	4.233 $^{(1.752)}$	6.247 $^{(1.921)}$	78.000 (16.088)	0.333 (0.135)	0.019 (0.136)	0.204 $^{(0.152)}$	0.187 (0.086)
		Total	172	4.250 $^{(1.820)}$	6.076 $^{(1.904)}$	78.622 (14.822)	0.310 (0.088)	0.112 (0.089)	0.261 $^{(0.099)}$	0.117 (0.056)
	Unfamiliar voice	Same gender	94	4.745 $^{(1.722)}$	6.330 $^{(1.851)}$	75.053 (22.299)	0.024 (0.118)	-0.054 (0.119)	-0.018$^{(0.133)}$	0.039 (0.075)
		Different gender	106	5.726 $^{(1.607)}$	6.057 $^{(2.101)}$	71.198 (20.481)	-0.493 (0.111)	-0.107 (0.111)	-0.370$^{(0.125)}$	-0.187 (0.070)
		Total	200	5.265 $^{(1.729)}$	6.185 $^{(1.988)}$	73.010 (21.387)	-0.234 (0.081)	-0.080 (0.081)	-0.194$^{(0.091)}$	-0.074 (0.052)
	Total	Same gender	193	4.497 $^{(1.815)}$	6.135 $^{(1.877)}$	77.119 (18.527)	0.156 (0.083)	0.076 (0.083)	0.150 $^{(0.093)}$	0.044 (0.053)
		Different gender	179	5.117 $^{(1.818)}$	6.134 $^{(2.026)}$	73.972 (19.062)	-0.080 (0.087)	-0.044 (0.088)	-0.083$^{(0.098)}$	0.000 (0.056)
		Total	372	4.796 $^{(1.840)}$	6.134 $^{(1.948)}$	75.605 (18.827)				

Table 5-4 shows the mean differences of cognitive load and performance values between the familiar / unfamiliar voice groups and the same-gender / different gender groups:

Table 5-4: Familiar *versus* unfamiliar voice and same gender *versus* different gender-Independent T-Test for cognitive loads and performance

		Mean cognitive load learning (SD, N)	Mean cognitive load Rec (SD, N)	Mean cognitive load Trn (SD, N)	Mean task performance Rec (SD, N)	Mean task performance Trn (SD, N)
	Familiar voice	4.26 (1.82,175)	4.65 (1.79, 173)	6.07 (1.90, 172)	81.03 (13.38, 173)	78.40 (15.07, 173)
	Unfamiliar voice	5.26 (1.72,201)	5.36 (2.05, 200)	6.18 (1.99, 200)	77.30 (17.00, 200)	73.01 (21.39, 200)
	Mean difference 95% Confidence Interval of the Difference- (Lower, Upper)	-1.00*** (-1.36, -0.64)	-0.71*** (-1.10, -0.31)	-0.11 (-0.51, 0.29)	3.73** (0.58, 6.88)	5.39*** (1.57, 9.21)
Familiar voice	**Same gender**	4.28 (1.87,101)	4.74 (1.81,100)	5.94 (1.89,99)	81.07 (13.08,100)	78.69 (14.35,100)
	Different gender	4.22 (1.74,74)	4.56 (1.76,73)	6.24 (1.92,73)	80.97 (13.86,73)	78.00 (16.08,73)
	Mean difference 95% Confidence Interval of the Difference- (Lower, Upper)	0.057 (-0.49, 0.60)	0.168 (-0.37, 0.71)	-0.297 (-0.88, 0.28)	0.097 (-4.02, 4.22)	0.69 (-3.99, 5.37)
Unfamiliar voice	**Same gender**	4.74 (1.71, 95)	4.84 (2.13,94)	6.32 (1.85, 94)	79.28 (17.50, 94)	75.05 (22.29,94)
	Different gender	5.72 (1.60, 106)	5.83 (1.86, 106)	6.05 (2.10, 106)	75.53 (16.41, 106)	71.19 (20.48,106)
	Mean difference 95% Confidence Interval of the Difference- (Lower, Upper)	-0.97*** (-1.44, -0.52)	-0.98*** (-1.55, -0.43)	0.27 (-28, 0.83)	3.74 (-0.98, 8.50)	3.85 (-2.14, 9.85)

**P<0.05, ***P<0.01

In Table 5-4 it can be seen that the cognitive load during the learning phase of the familiar voice group (M=4.26, SD=1.82) was lower than that of the unfamiliar voice group (M=5.26, SD=1.72) and the difference between the groups was significant (MD=-1.00, P<0.01). The cognitive load on the recall test of the familiar voice group (M=4.65, SD=1.79) was lower than that of the unfamiliar voice group (M=5.36, SD=2.05) and the difference between the groups is significant (MD=-0.71, P<0.01). The cognitive load on the transfer test of the familiar voice group (M=6.07, SD=1.90) was lower than that of the unfamiliar voice group (M=6.18, SD=1.99). However, the difference between the groups was not significant (MD=-0.11, P>0.1). The performance score on the recall test of the familiar voice group (M=81.03, SD=13.38) was higher than that of the unfamiliar voice group (M=77.30, SD=17.00) and the difference between the groups is significant (MD=3.73, P<0.05). The performance score on the transfer test of the familiar voice group (M=78.40, SD=15.07) was higher than that of the unfamiliar voice group (M=73.01, SD=21.39) and the difference between the groups is significant (MD=5.39, P<0.01).

As regards the differences between the same gender and different gender groups: the difference between the cognitive load on learning of the familiar voice same-gender group (M=4.28, SD=1.87) and the familiar voice different-gender group (M=4.22, SD=1.74) was insignificant (MD=0.057, P>0.05). The difference between the cognitive load on the recall task of the familiar voice same-gender group (M=4.74, SD=1.81) and the familiar voice different-gender group (M=4.56, SD=1.76) was insignificant (MD=0.168, P>0.05). The difference between the cognitive load on the transfer task of the familiar voice same-gender group (M=5.94, SD=1.89) and the familiar voice different-gender group (M=6.24, SD=1.92) was insignificant (MD=-0.297, P>0.05). The difference between the performance of the recall task of the familiar voice same-gender group (M=81.07, SD=13.08) and the familiar voice different-gender group (M=80.97, SD=13.86) was insignificant (MD=0.097, P>0.05). The difference between the performance of the transfer task of the familiar voice same-gender group (M=78.69, SD=14.35) and the familiar voice different-gender group (M=78.00, SD=16.08) was insignificant (MD=0.69, P>0.05). The difference between the cognitive load on learning of the unfamiliar voice same-gender group (M=4.74, SD=1.71) and the unfamiliar voice different-gender group (M=5.72, SD=1.60) was significant (MD=-0.97, P<0.01). The difference between the cognitive load on the recall task of the unfamiliar voice same-gender group (M=4.84, SD=2.13) and the unfamiliar voice different-gender group (M=5.83, SD=1.86) was significant (MD=-0.98, P<0.01). The difference between the cognitive load on the transfer task of the unfamiliar voice same-gender group (M=6.32, SD=1.85) and the unfamiliar voice different-gender group (M=6.05, SD=2.10) was insignificant (MD=0.27, P>0.05). The difference between the performance of the recall task of the unfamiliar voice same-gender group (M=79.28, SD=17.50) and the unfamiliar voice different-gender group (M=75.53, SD=16.41) was insignificant (MD=3.74, P>0.05). The difference between the performance of the transfer task of the unfamiliar voice same-gender group (M=75.05, SD=22.29) and the unfamiliar voice different-gender group (M=71.19, SD=20.48) was insignificant (MD=3.85, P>0.05).

5.1.2 The MANCOVA assumptions

Hypotheses were tested using **Multivariate analysis of covariance** (MANCOVA), since there were nine dependent variables (LPE-Rec and Trn, TE-Rec and Trn, 3D-E-Rec and Trn, MT-Rec and Trn and NVSC-A) and two covariates (gender and computer previous experience).

MANCOVA makes several assumptions (Tabachnick and Fidell, 2001; Stevens, 2002):

1. ***Assumption of independence***: The observations should be independent of one another;
2. ***Normal distribution*****:** The dependent variables should be normally distributed;
3. ***Homogeneity of variances*****:** It is presumed that the variance of all groups is equal;
4. ***Multivariate normality*****:** Multivariate normality is required;
5. ***Level and Measurement of the Variables*****:** Dependent and covariate variables should continue as metric variables, grouping variables should be nominal;
6. ***Multicollinearity and singularity*****-**for best results the dependent variables should be only moderately correlated

The research data were examined according to these assumptions:

1. ***Assumption of independence***: As stated in the methodology chapter 382 students participated in the research. Each of the students participated in one experiment;
2. ***Normal distribution*****:** According to the central limit theorem, a sufficiently large number of cases, each with finite mean and variance, will be approximately normally distributed (Smith and Wells, 2006). In the present research, the research sample consisted of 382 students and each cell contained more than 30 cases so a normal distribution could be assumed;

3. ***Homogeneity of variances*:** To test the research sample for this presumption the Levene's Test of Equality of Error Variances was performed for each of the dependent variables, as shown in Table 5-5;

Table 5-5: Levene's Test of Equality of Error Variances

	Levene's F-statistics	DF1	DF2	sig
LPE-Rec	0.564	3	369	0.639
LPE-Trn	0.400	3	369	0.753
TE-Rec	2.628	3	368	0.050
TE-Trn	1.057	3	368	0.367
3D-E-Rec	1.552	3	368	0.201
3D-E-Trn	0.438	3	368	0.726
MT-Rec	2.795	3	368	0.040*
MT-Trn	4.660	3	368	0.003*
NVSC -A	0.511	3	378	0.675

$P<0.05$

As seen in Table 5-5, all the dependent variables except for MT-Rec and MT-Trn were found to be insignificant, that is, the variance of these variables is equal. MT-Rec and MT-Trn were found to be significant, that is, the variance of these variables is not equal, which means the assumption of homogeneity among groups (the familiar and unfamiliar voice groups) is violated for these two variables and this might distort the MANCOVA test, which assumes homogeneity. Since, all the other variables did not violate the homogeneity assumption, and provided that all the indices in the study were calculated using the same set of data, a possible explanation for this might be related to the suggested equation used for calculating motivation on task (MT). As mentioned in section 3.1.5 the MT equation is not free of concern and in some cases, the results may be distorted. Thus, this will have to be taken into consideration when interpreting the results of this research in regards to motivation on task and a deeper look will be taken into this specific calculation in order to find out what happened (see section 6.1.1).

4. ***Multivariate normality*:** The Central Limit Theorem implies that the sample mean vectors are going to be approximately multivariate normally distributed with a sample >30 (Smith and Wells, 2006). In this research, sample size was 382.
5. ***Level and Measurement of the Variables*:** In the present research, all the dependent variables and three of the independent variables, conscientiousness, test-

anxiety and computer-experience are continuous. The non-continuous variables are gender, voice-familiarity and voice-familiarity X gender-similarity and these variables are categorised by nominal values;

6. ***Multicollinearity and singularity-*** In the present study the recall and transfer task scores were highly correlated ($r=0.803$, $p<0.01$), see Table 5-1. However, it was chosen not to unite them, since they represent different types of task performance.

5.1.3 Findings related to hypotheses regarding voice familiarity

Hypothesis 1 asserted that the learning and performance efficiency indices of the students who heard a familiar voice would be higher than the learning and performance efficiency indices of students who heard an unfamiliar voice.

MANCOVA was conducted to determine the influence of voice familiarity using gender and computer previous experience as covariates, on three efficiency measurements: Learning Process Efficiency (LPE), Task Efficiency (TE) and 3-Dimensional learning Efficiency (3D-E) and Motivation on Task (MT). These measurements were calculated using the formulas described in sections 3.1.4 and 3.1.5 and they are represented in graphs according to the model described there.

Pillai's criterion was used as the multivariate test statistic because of the unequal cell sizes and Partial η^2 was used as the effect size measure, which exhibits the strength of the association between a predictor and the dependent variable. According to Cohen (1988), 0.0099 constitutes a small effect, 0.0588 a medium effect and 0.1379 a large effect. In this study, Partial η^2 points to the proportion of total variation attributable to each of the independent variables, excluding other factors from the total variation in the various learning efficiency indices. Whenever the MANCOVA results were found to be significant tests of between subject effects were used for the recall and transfer tests' efficiency of each of the three efficiency indices and the motivation on task index (Hair, et al., 1998; Francis, 2007).

Table 5-6 presents the raw and marginal means of the three efficiency indices in recall and transfer tests with familiar and unfamiliar voice:

Table 5-6: Familiar versus unfamiliar voice-raw and marginal means of the three efficiency indices

			LPE					TE					3D-E				
		N	**Raw mean** (SD)	**Marginal Mean**	**F** (DF)	**Skewness**	**Kurtosis**	**Raw mean** (SD)	**Marginal Mean**	**F** (DF)	**Skewness**	**Kurtosis**	**Raw mean** (SD)	**Marginal Mean**	**F** (DF)	**Skewness**	**Kurtosis**
Recall task	**Familiar Voice**	172	0.296 (1.179)	0.303 (0.091)	18.42^{***} (1,363)	-0.212	-0.547	0.23 (1.147)	0.241 (0.09)	10.00^{***} (1,362)	-0.594	0.457	0.361 (1.353)	0.366 (0.106)	19.20^{***} (1,362)	-0.207	-0.260
	Unfamiliar Voice	200	-0.259 (1.262)	-0.224 (0.084)		-0.655	0.735	-0.2 (1.372)	-0.162 (0.087)		-0.443	-0.128	-0.307 (1.498	-0.261 (0.097)		-0.276	-0.081
Transfer task	**Familiar Voice**	172	0.313 (1.096)	0.310 (0.088	20.96^{***} (1,363)	-0.248	-0.180	0.14 (1.093)	0.112 (0.089)	2.70^{*} (1,362)	-0.140	-0.158	0.285 (1.281)	0.261 (0.099)	11.61^{***} (1,362)	-0.294	-0.294
	Unfamiliar Voice	200	-0.274 (1.260)	-0.234 (0.081)		-0.755	0.620	-0.11 (1.271)	-0.080 (0.081		-0.487	0.147	-0.238 (1.388)	-0.194 (0.091)		-0.405	-0.066

*P<0.10, ***P<0.01

Tables 5-6 to 5-11 demonstrate the raw and marginal means of the dependent variables. Since 'gender' and 'computer experience' correlated with some of the dependent variables (see Table 5-1) and these variables were not of interest in this study (see section 4.4), they were controlled during the MANCOVA tests. The 'raw mean' column exhibits the value of each of the indices before controlling 'gender' and 'computer experience' and the 'marginal means' column exhibits the adjusted statistic mean after controlling those variants, which gives us a more accurate picture of the contribution of voice familiarity to the explained variance between the familiar voice and unfamiliar voice groups .

Results for hypothesis 1.1

In testing **hypothesis 1.1,** which asserted that the efficiency of the learning process (LPE) of students who heard a familiar voice would be higher than that of students who heard an unfamiliar voice, the following results were obtained:

- Using ***Multivariate Tests,*** the following indices related to voice familiarity were: Pillai's Trace=0.055' MF(2,362)=10.463, P<0.001, Partial η^2=0.055, meaning that there is an influence of voice familiarity on learning process efficiency (LPE).
- Since the ***Multivariate Tests*** yielded significant results, ***Tests of Between-Subjects Effects*** were administered for the influence of voice familiarity on the learning process efficiency in the recall and transfer tests. The results showed a significant impact of voice familiarity in the recall test (LPE-Rec); F(1,363)=18.423, P<0.001, Partial η^2=0.048.
- As shown in Table 5-6 the marginal mean of LPE-Rec of students who were exposed to a familiar voice (M=0.303) was significantly higher than students who were exposed to an unfamiliar voice (M=-0.224).
- A significant influence was also found in the transfer test (LPE-Trn); F(1,363)=20.965, P<0.01, Partial η^2=0.055.
- As shown in Table 5-6 the marginal mean of the learning process efficiency index in the transfer test (LPE-Trn) of students who were exposed to a familiar voice (M=0.310) was significantly higher than students who were exposed to an unfamiliar voice (M=-0.234). See also Figure 5-1 and Figure 5-2. Both figures were created using MS Excel 2007™.

Thus, **hypothesis 1.1** was confirmed. In other words, studying with a NVSC with a familiar narrator resulted in higher learning process efficiency (see section 3.1.4).

The following two figures represent the learning process efficiency indices and their location in the high/low efficiency quadrants:

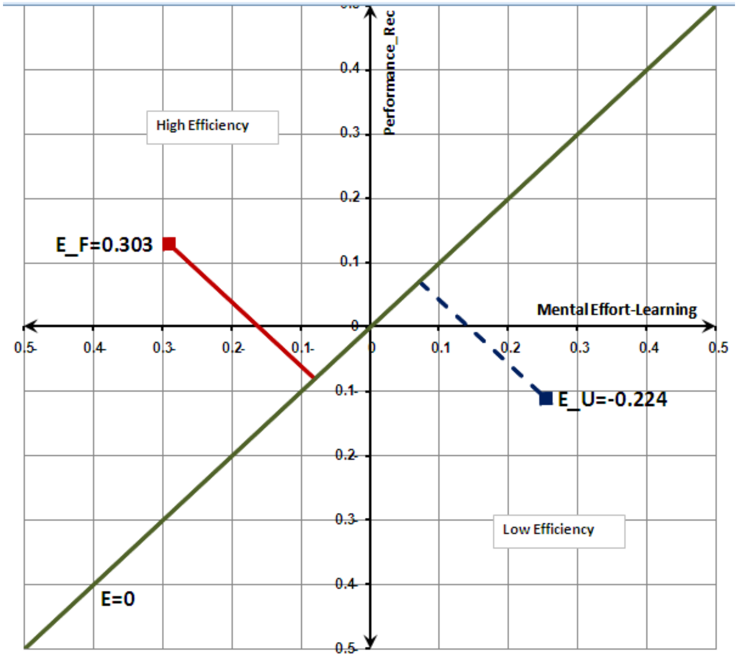

Figure 5-1: Familiar *versus* unfamiliar voice-learning process efficiency in the recall test (LPE-Rec)-Marginal means

Unfamiliar voice group- E_U- - - - - , Familiar voice group- E_F

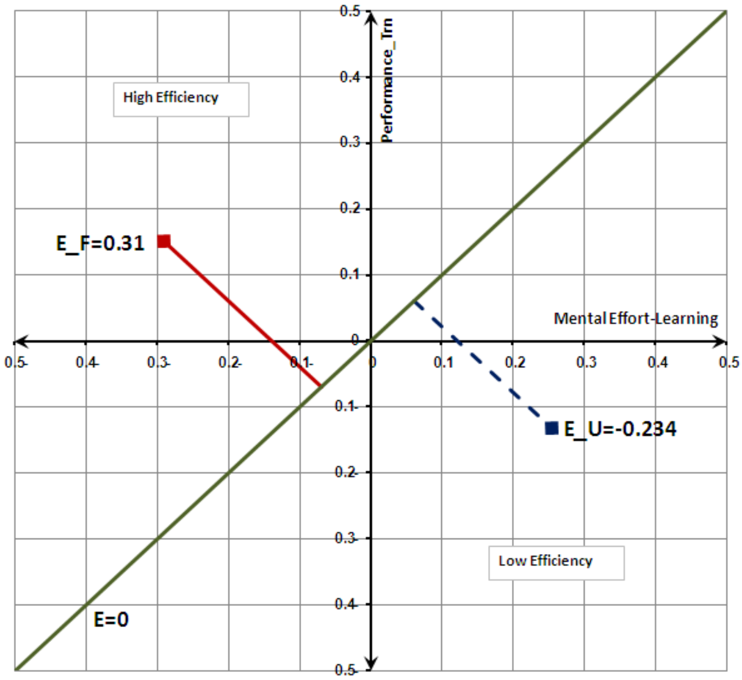

Figure 5-2: Familiar *versus* unfamiliar voice-learning process efficiency in the transfer test (LPE-Trn) -Marginal means

Unfamiliar voice group- E_U- - - - - , Familiar voice group- E_F

In both figures, it is shown that the familiar voice group's efficiency was on the high efficiency zone while the unfamiliar voice group's efficiency was on the low efficiency zone, according to the model suggested by van Gog and Wells (2008).

Results for hypothesis 1.2

In testing **hypothesis 1.2,** which asserted that the efficiency of task performance (TE) of students who heard a familiar voice would be higher than that of students who heard an unfamiliar voice, the following results were obtained:

- Using ***Multivariate Tests,*** the following indices related to voice familiarity were: Pillai's Trace=0.033, $MF(2,361)=6.102$, $P<0.01$, Partial $\eta^2=0.033$, meaning that there is an influence of voice familiarity on task efficiency (TE).
- **Tests of between subjects effects** for the influence of voice familiarity on task efficiency was used to test the impact of voice familiarity in recall and transfer test. A significant impact of voice familiarity was found on the recall test (TE-Rec); $F(1,362)=10.009$, $P<0.01$, Partial $\eta^2=0.027$.
- As shown in Table 5-6 the marginal mean of TE-Rec among students who were exposed to a familiar voice (M=0.241) was significantly higher than students who were exposed to an unfamiliar voice (M=-0.162), see Figure 5-3.
- Only limited significant influence of voice familiarity was found in the transfer test (TE-Trn); $F(1,362)=2.708$, $P=0.10$, Partial $\eta^2=0.007$.
- As shown in Table 5-6 the marginal mean of TE-Trn among students who were exposed to a familiar voice (M=0.112(was higher than students who were exposed to an unfamiliar voice (M=-0.080) but the difference showed only limited significance (p=0.10), see Figure 5-4

Thus, **hypothesis 1.2** was only partially confirmed. In other words, studying with a NVSC with a familiar narrator resulted in significantly higher task performance efficiency in recall and transfer tasks (see section 3.1.4).

The following two Figures demonstrate the task efficiency indices for recall and transfer tests; TE-Rec and TE-Trn in accordance and their location in the high/low efficiency quadrates:

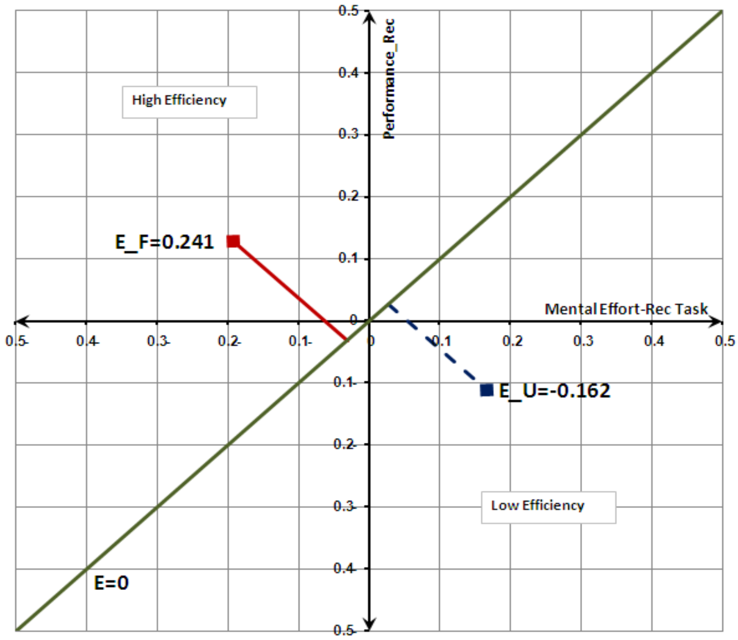

Figure 5-3: Familiar *versus* unfamiliar voice-task efficiency in the recall test (TE-Rec) -Marginal means

Unfamiliar voice group- E_U- - - - - , Familiar voice group- E_F__________

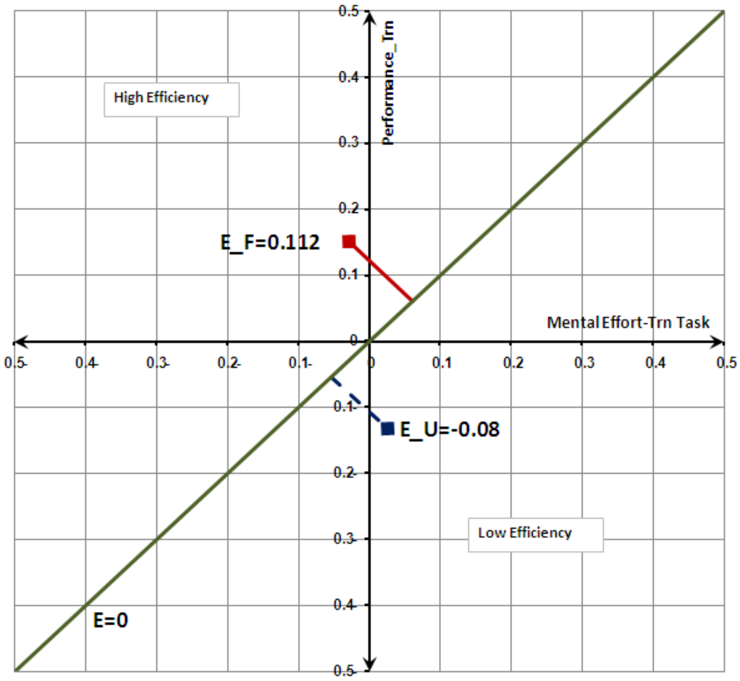

Figure 5-4: Familiar *versus* unfamiliar voice-task efficiency in the transfer test (TE-Trn) -Marginal means

Unfamiliar voice group- E_U- - - - - , Familiar voice group- E_F

In both figures, it is shown that the familiar voice group's efficiency was on the high efficiency quadrate while the unfamiliar voice group's efficiency was on the low efficiency quadrate, according to the model suggested by van Gog and Paas (2008).

Results for hypothesis 1.3

In testing **hypothesis 1.3,** which asserted that the three-dimensional learning efficiency (3D-E) of students who heard a familiar voice would be higher than that of students who heard an unfamiliar voice, the following results were obtained:

- Using ***Multivariate Tests*,** the following indices related to voice familiarity were: Pillai's Trace=0.054, MF(2,361)=10.241, $P<0.001$, Partial $\eta^2=0.054$, which means that there was an influence of voice familiarity on the three-dimensional learning efficiency index (3D-E).
- ***Tests of Between-Subjects Effects*** for The Influence of voice familiarity on the three-dimensional learning efficiency index showed a significant difference in both recall and transfer tests. For the recall test (3D-E-Rec); $F(1,362)=19.205$, $P<0.001$, Partial $\eta^2=0.05$ and as shown in Table 5-6 the marginal mean of 3D-E-Rec among students who were exposed to a familiar voice (M=0.366) was significantly higher than students who heard an unfamiliar voice (M=**-**0.261).
- In the transfer test (3D-E-Trn); $F(1,362)=11.618$, $P<0.01$, Partial $\eta^2=0.031$, as shown in Table 5-6, the 3D-E-Trn marginal mean for students who were exposed to a familiar voice (M=0.261) was significantly higher than students who were exposed to an unfamiliar voice (M=**-**0.194), see also Figure 5-5 and Figure 5-6 .

Thus, **hypothesis 1.3** was confirmed. In other words, studying with a NVSC with a familiar narrator resulted in higher three dimensional learning process efficiency in both recall and transfer task (see section 3.1.4).

The following figures (Figure 5-5 and Figure 5-6), demonstrate the three dimensional efficiency indices and their location in the high/low efficiency octants. Both figures were drawn following the model suggested by Tuovinen and Paas (2004) using MuPad Version 5.5.0, (MathWorks, n.d.)

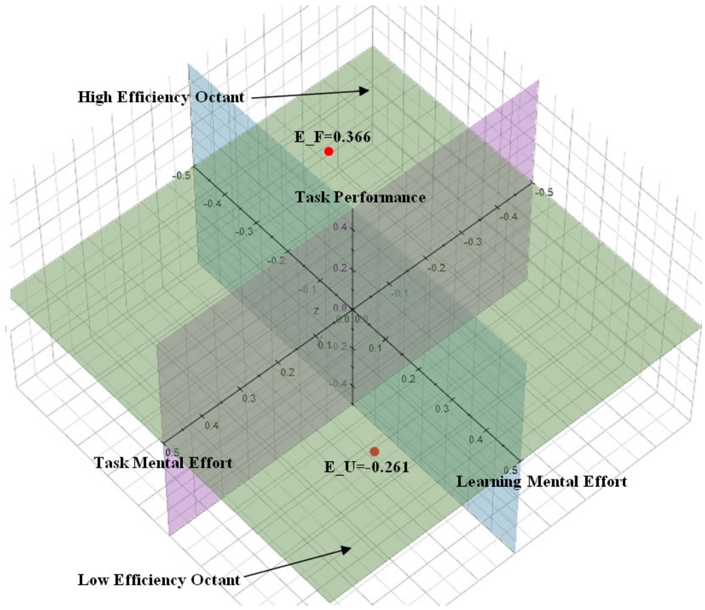

Figure 5-5: Familiar *versus* unfamiliar voice-three dimensional learning efficiency in the recall Test (3D-E-Rec) -Marginal means

(E_U represents the index of the unfamiliar voice group; E_F represents the index of the familiar narrator group).

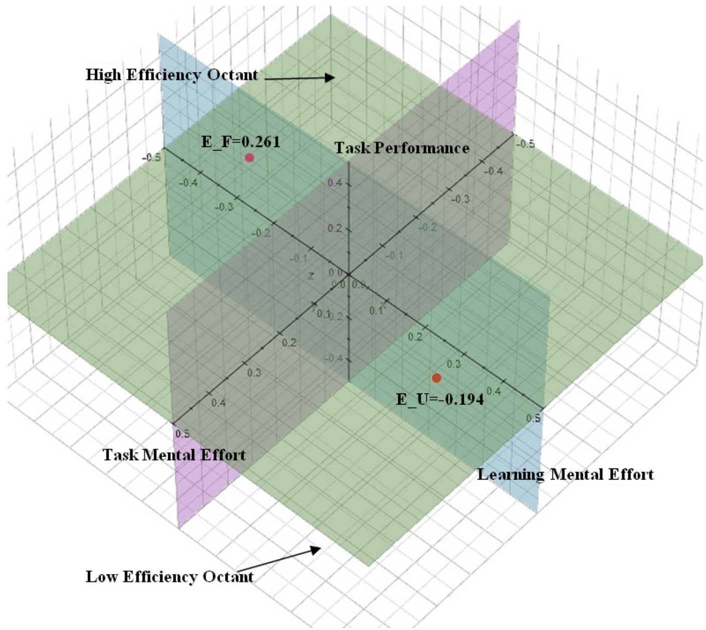

Figure 5-6: Familiar *versus* unfamiliar voice-three dimensional learning efficiency in the transfer test (3D-E-Trn) -Marginal means

(E_U represents the index of the unfamiliar voice group; E_F represents the index of the familiar narrator group)

In both figures, it is shown that the familiar voice group's efficiency was on the high efficiency octant while the unfamiliar voice group's efficiency was on the low efficiency octant, according to the model suggested by Tuovinen and Paas (2004).

The following two figures (Figure 5-7 and Figure 5-8) demonstrate a comparison of the three efficiency indices in relation to voice familiarity in recall and transfer tests. Significant differences are marked with asterisks.

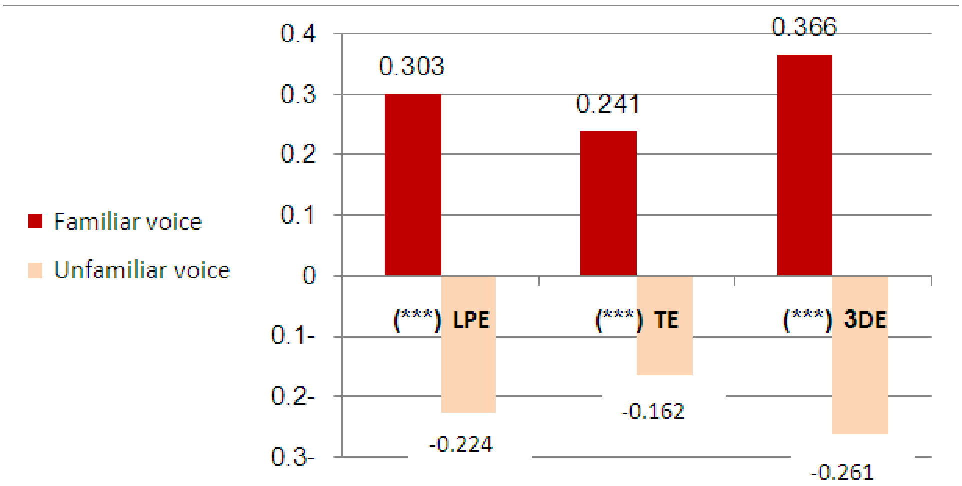

Figure 5-7: Familiar *versus* unfamiliar voice-comparison of the three efficiency measurements in the recall task-Marginal means

***P<.01

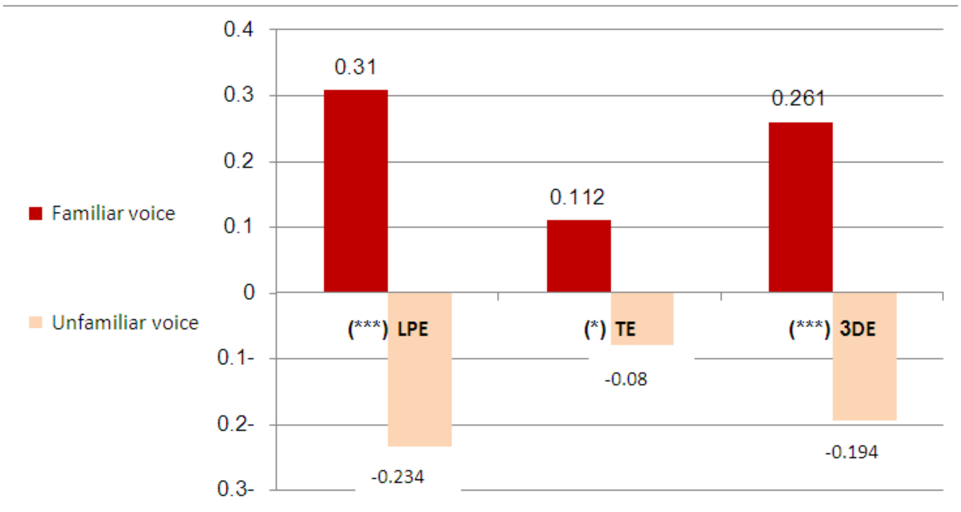

Figure 5-8: Familiar *versus* unfamiliar voice-comparison of the three efficiency measurements in the transfer task-Marginal means

*P<.10, ***P<.01

In testing **hypothesis 2,** which asserted that the degree of motivation for performing a task (MT) in the case of students who heard a familiar voice would be higher than that of students who heard an unfamiliar voice, the following results were obtained and shown in Table 5-7:

Table 5-7: Familiar versus unfamiliar voice-raw and marginal means of the motivation on task index (MT)

		N	Raw mean (SD)	Marginal mean (SE)	F (DF)	skewness	kurtosis
Recall task	Familiar Voice	172	-0.038 (0.508)	-0.031 (0.044)	0.95 (1,362)	-0.788	0.070
	Unfamiliar Voice	200	0.039 (0.637)	0.029 (0.040)		-0.766	4.369
Transfer task	Familiar Voice	172	0.095 (0.614)	0.117 (0.056)	6.35** (1,362)	-0.435	0.375
	Unfamiliar Voice	200	-0.075 (0.841)	-0.074 (0.052)		-0.963	2.363

**P<0.05

Results for hypothesis 2

Using ***Multivariate Tests,*** the following indices related to voice familiarity were obtained:

- Pillai's Trace=0.035, MF(2,361)=6.577, P<0.01, Partial η^2=0.035, which means that there is an impact of voice familiarity on the motivation on task (MT).
- Tests of Between-Subjects Effects for the influence of voice familiarity on the motivation on task showed no significant impact of voice familiarity in the recall
- As shown in Table 5-7 the marginal mean of MT-Rec among students who were exposed to a familiar voice (**M=**-0.031) was lower than students who were exposed to an unfamiliar voice (**M=**0.029), which is in contradiction to **hypothesis 2**, however, that difference was not significant.

- A significant influence was found in the transfer test (MT-Trn); $F(1,362)=6.346$, $P<0.05$, Partial $\eta^2=0.017$.
- As shown in Table 5-7 the MT-Trn marginal mean among students who were exposed to a familiar voice (M=0.117) was significantly higher than students who were exposed to an unfamiliar voice (M=-0.074) see Figure 5-9 and Figure 5-10.

Thus, **hypothesis 2** was only partially confirmed. In other words, studying with a NVSC with a familiar narrator resulted in higher motivation only on the transfer task and there was no difference between the two groups in the recall task (see section 3.1.5).

The following figures (Figure 5-9 and Figure 5-10), show the motivation on task index and its location in the high/low efficiency quadrates:

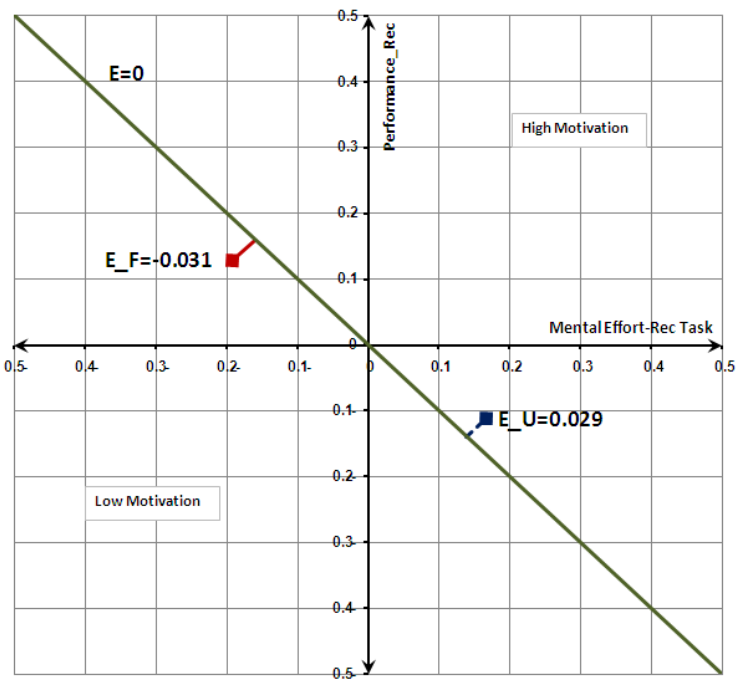

Figure 5-9: Familiar *versus* unfamiliar voice-motivation on task in the recall test (MT-Rec) -Marginal means

Unfamiliar voice group- E_U- - - - - , Familiar voice group- E_F

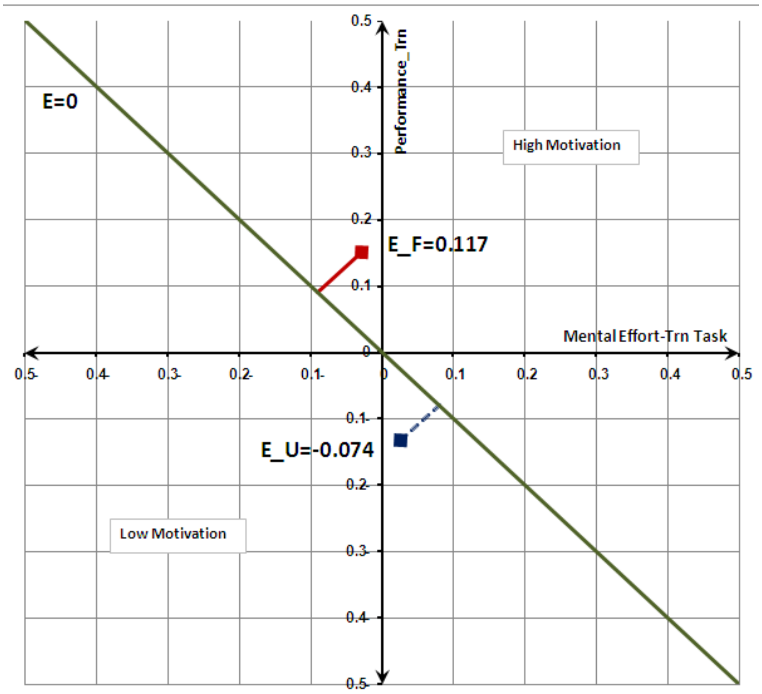

Figure 5-10: Familiar *versus* unfamiliar voice-motivation on task in the transfer test (MT-Trn) -Marginal means

Unfamiliar voice group- E_U- - - - - , Familiar voice group- E_F

In the MT-Rec (Figure 5-9) it is shown, that the familiar voice group's motivation was on the lower motivation quadrate, while the unfamiliar voice group's efficiency was on the upper motivation quadrate, according to the model suggested by Paas, et al. (2005). Whereas, in the MT-Trn (Figure 5-10) it is shown that the familiar voice group's motivation was on the lower motivation zone while the unfamiliar voice group's efficiency was on the upper motivation zone.

Results for hypothesis 3

In testing **hypothesis 3,** which asserted that the assessment score of the NVSC of students who heard a familiar voice would be higher than that of students who heard an unfamiliar voice, the following results were obtained (Table 5-8):

Table 5-8: NVSC assessment for familiar and unfamiliar voice (NVSC-A)

		N	Raw mean (SD)	Marginal Mean (SE)	F $^{(DF)}$
NVSC Assessment	**Familiar Voice**	180	4.654 $^{(0.793)}$	4.657 $^{(0.061)}$	12.471*** (1,372)
	Unfamiliar Voice	202	4.354 $^{(0.832)}$	4.363 $^{(0.056)}$	
	Total	382			

*****P<0.01**

- ***Tests of Between-Subjects Effects*** showed a significant impact of voice familiarity on the NVSC assessment (NVSC-A) score**;** F(1,372)=12.471, P<0.001, Partial η^2=0.032.
- According to Table 5-8, the marginal mean of the NVSC-A score among students who were exposed to a familiar voice (M=4.657) was significantly higher than students who were exposed to an unfamiliar voice (M=4.363), see Figure 5-11.

Thus, **hypothesis 3** was confirmed. In other words, students' perception of a NVSC with a familiar narrator was higher than with an unfamiliar voice.

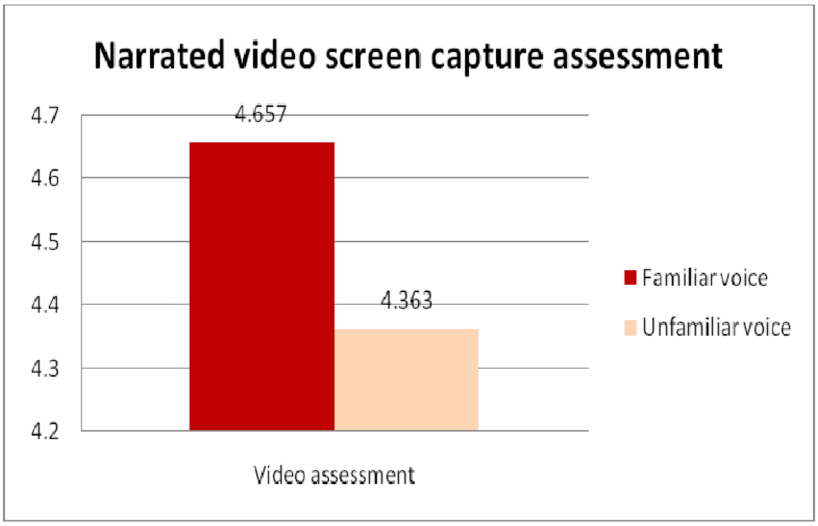

Figure 5-11 : Familiar *versus* unfamiliar voice-NVSC assessment scores (NVSC-A)

In summation, it was shown that there is an influence of voice familiarity on the three learning efficiency indices, on motivation on task and on students' perception of the learning material.

Students who were exposed to a familiar voice learned and performed the task more efficiently than students who were exposed to an unfamiliar voice, but in the transfer task, there was only a limited significant difference between the two groups. Students who were exposed to a familiar voice showed more motivation on transfer task, but not in the recall task and students' perception of the NVSC was higher when the narrator was familiar to them.

5.1.4 Findings related to hypotheses regarding gender similarity and voice familiarity

Hypothesis 4 asserted that the learning and performance efficiency indices of students who heard an unfamiliar voice belonging to a gender identical to theirs would be higher than the learning and performance efficiency indices of students who heard an unfamiliar voice belonging to a different gender. There will be no influence of gender similarity when the voice of the narrator is familiar.

In order to test this hypothesis an interaction variable was created; voice familiarity * gender similarity:

- Familiar voice of the same gender as student's;
- Familiar voice of the opposite gender;
- Unfamiliar voice of the same gender;
- Unfamiliar voice of the opposite gender;

The following table represents the raw and marginal means of the three learning indices in relation to voice familiarity and gender similarity:

Table 5-9: Raw and marginal means of the three efficiency indices in relation to voice familiarity and gender similarity

				LPE			TE			3-DE		
			N	**Raw mean (SD)**	**Marginal Mean (SE)**	**F (DF)**	**Raw mean (SD)**	**arginal Mean (SE)**	**DF)**	**Raw mean (SD)**	**Marginal Mean (SE)**	**F (DF)**
Recall task	**Familiar Voice**	**Same gender**	99	0.289 (1.174)	0.260 (0.119)	6.277** (1,363)	0.211 (1.148)	0.215 (0.125)	4.855** (1,362)	0.340 (1.360)	0.325 (0.139)	7.925*** (1,362)
		Different gender	73	0.306 (1.193)	0.345 (0.140)		0.260 (1.153)	0.267 (0.146)		0.390 (1.351)	0.407 (0.163)	
	Unfamiliar Voice	**Same gender**	94	0.032 (1.303)	0.044 (0.122)		0.083 (1.494)	0.098 (0.127)		0.084 (1.619)	0.106 (0.142)	
		Different gender	106	-0.517 (1.172)	-0.493 (0.114)		-0.444 (1.209)	-0.422 (0.119)		-0.655 (1.294)	-0.627 (0.133)	
Transfer task	**Familiar Voice**	**Same gender**	99	0.315 (1.068)	0.287 (0.115)	5.490** (1,363)	0.201 (1.069)	0.206 (0.117)	0.310 (1,362)	0.332 (1.258)	0.318 (0.130)	0.771 (1,362)
		Different gender	73	0.311 (1.140)	0.333 (0.135)		0.052 (1.126)	0.019 (0.136)		0.221 (1.317)	0.204 (0.152)	
	Unfamiliar Voice	**Same gender**	94	0.003 (1.335)	0.024 (0.118)		-0.088 (1.298)	-0.054 (0.119)		-0.055 (1.458)	-0.018 (0.133)	
		Different gender	106	-0.519 (1.140)	-0.493 (0.111)		-0.133 (1.252)	-0.107 (0.111)		-0.401 (1.309)	-0.370 (0.125)	

**p<0.05, ***p<0.01

Results for hypothesis 4.1

Hypothesis 4.1 asserted that when the voice is unfamiliar the efficiency of the learning process (LPE) of students who heard a voice belonging to a gender that is identical to theirs would be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the level of efficiency of the learning process (LPE) of students who heard a voice belonging to a gender identical to theirs *vis-à-vis* students who heard a voice belonging to a different gender. The following results were obtained:

- Using ***Multivariate Tests,*** it was found that there was a significant interaction of the familiarity with the NVSC narrator and the similarity of narrator's gender to that of the student; Pillai's Trace=0.017, MF(2,362)=3.131, $P<0.05$, Partial $\eta^2=0.017$.
- In ***Tests of Between-Subjects Effects*** for the interaction between voice familiarity and gender similarity for testing the learning process efficiency in the recall test (LPE-Rec), a significant impact was found $F(1,363)=6.277$, $P<0.05$, Partial $\eta^2=0.017$.

In order to control for the type 1 error rate, which happens when a test incorrectly reports that it has found a result where none really exists, the **Bonfferoni *post hoc* test for pairwise comparisons** was used and the following results were obtained:

- The LPE-Rec score among students who heard an unfamiliar voice of the same gender (M=0.044) was significantly higher ($p<0.01$) than students who were exposed to an unfamiliar voice of a different gender (M=-0.493).
- No significant difference ($p>0.05$) in the LPE-Rec score was found between students who were exposed to a familiar voice of the same gender (M=0.260) and students who were exposed to a familiar voice of a different gender (M=0.345) (see Table 5-9).
- Testing the interaction between voice familiarity and gender similarity for the LPE-Trn index found a significant interaction; $F(1,363)=5.490$, $P<0.05$, Partial $\eta^2=0.015$.
- LPE-Trn score for students who were exposed to an unfamiliar voice of the same gender (M=0.(024 was significantly higher ($p<0.01$) than students who were exposed to an unfamiliar voice of a different gender (M=-0.493).

- No significant difference was found (p>0.05) between LPE-Trn score of students who were exposed to a familiar voice of the same gender (M=0.287) and students who were exposed to a familiar voice of a different gender (M=0.333). See Table 5-9, Figure 5-12 and Figure 5-13, which demonstrate the differences between the gender-similarity groups of the learning process indices in recall and transfer test, with familiar and unfamiliar voice.

Thus, **hypothesis 4.1** was confirmed**.** In other words, studying with a NVSC with an unfamiliar narrator of the same gender as the student resulted in higher learning process efficiency (see section 3.1.4) than with an unfamiliar narrator of a different gender. Gender similarity (see section 3.6.1) had no influence when the narrator was familiar.

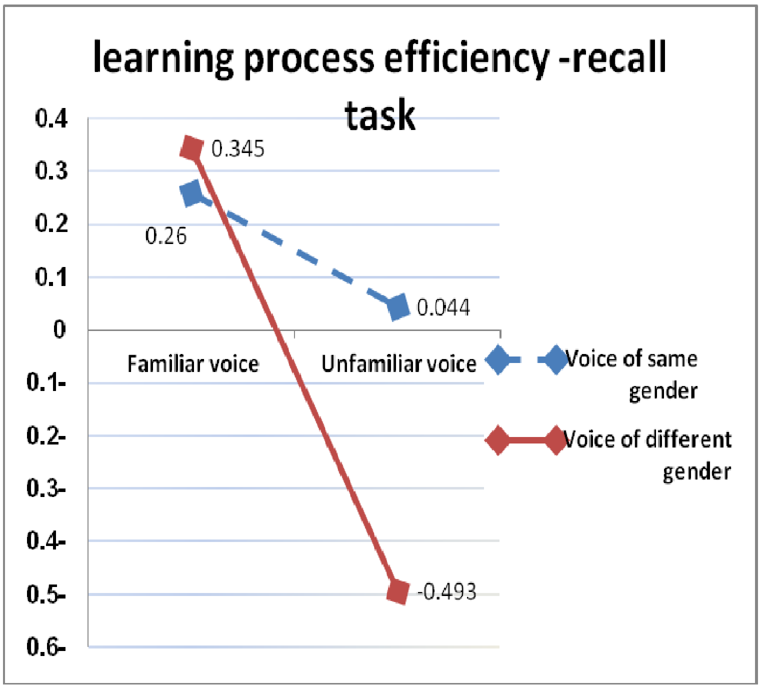

Figure 5-12: Voice familiarity and gender similarity- learning process efficiency in recall test (LPE-Rec) -Marginal means

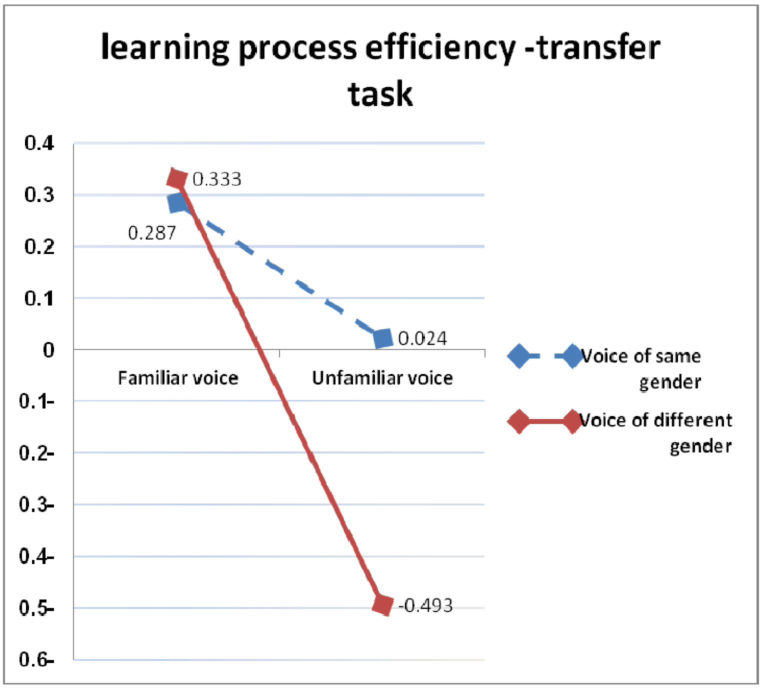

Figure 5-13 : Voice familiarity and gender similarity- learningprocess efficiency in transfer test (LPE-Trn) -Marginal means

In both of the figures above it is shown that in general, the learning process efficiency of the group of the same gender voice was higher than that of the group of the different gender voice. It is shown, that with a familiar voice there was no difference between the groups and in fact, there was a slight insignificant advantage to the group of the different gender voice. However, when shifting to the unfamiliar voice it is shown that there was a significant difference between the groups and the group of the same gender voice showed higher efficiency than that of the group of a different gender voice.

Results for hypothesis 4.2

Hypothesis 4.2 asserted that when the voice is unfamiliar the task performance efficiency (TE) of students who heard a voice belonging to a gender identical to theirs would be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the level of task performance efficiency (TE) of students who heard a voice belonging to a gender identical to theirs *vis-à-vis* students who heard a voice belonging to a different gender. The following results were obtained:

- Using ***Multivariate Tests,*** it was found that there was a significant interaction between the familiarity with the NVSC narrator and the similarity of the narrator's gender to that of the student Pillai's Trace=0.052, MF(2,361)=9.973, P<0.001, Partial η^2=0.052.
- In ***Tests of Between-Subjects Effects*** for the interaction between voice level of familiarity and gender similarity, for testing TE-Rec, a significant impact was found ; F(1,362)=4.855, P<0.05, Partial η^2=0.013.
- Using the ***Bonferroni post hoc test for pairwise comparisons***, the following results were obtained: the TE-Rec score among students who heard an unfamiliar voice of the same gender (M=0.098) was significantly higher (p<0.05) than students who were exposed to an unfamiliar voice of a different gender (M=-0.422(.
- No significant difference (p>0.05) in the TE-Rec score was found between students who were exposed to a familiar voice of the same gender (M=0.215) and students who were exposed to a familiar voice of different gender (M=0.267(, see Table 5-9.

- Testing the interaction between voice familiarity and gender similarity for the TE score in the transfer test (TE-Trn) found no significant interaction; F(1,362)=0.310, P>0.05, Partial η^2=0.001 see Figure 5-14 and Figure 5-15, which demonstrate the differences between the groups of the task efficiency indices in recall and transfer task, with familiar and unfamiliar voice.

Thus, **hypothesis 4.2** was only partially confirmed**.** In other words, studying with a NVSC with an unfamiliar narrator of the same gender as the student resulted in higher task performance efficiency (see section 3.1.4) than with an unfamiliar narrator of a different gender only in the recall task. Gender similarity (see section 3.6.1) had no influence when the narrator was familiar in both types of task.

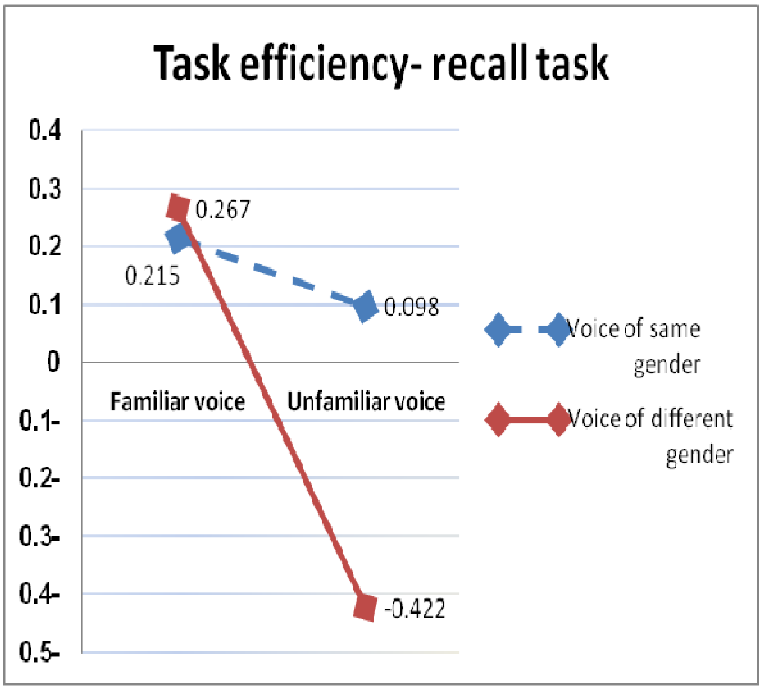

Figure 5-14: Voice familiarity and gender similarity- task efficiency in recall test (TE-Rec) -Marginal means

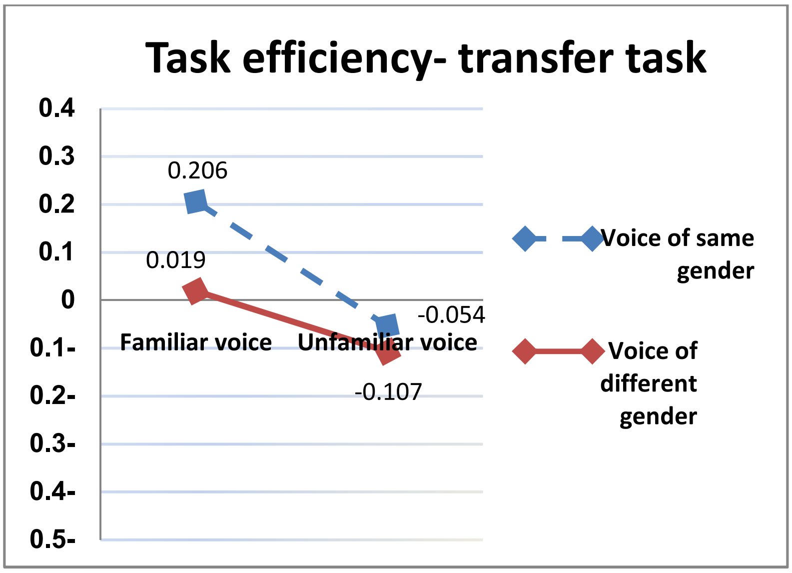

Figure 5-15: Voice familiarity and gender similarity- task efficiency in transfer test (TE-Trn) -Marginal means

In both figures, it is shown that in general, the task efficiency of the group of the same gender voice was higher than that of the group of the different gender voice. In the TE-Rec (see Figure 5-14), it is shown, that with a familiar voice there was no difference between the groups and in fact, there was a slight insignificant advantage to the group of the different gender voice. However, when shifting to the unfamiliar voice it is shown that there was a significant difference between the groups and the group of the same gender voice showed higher efficiency than that of the group of a different gender voice. The TE-Trn demonstrates the same direction but the difference between the groups in not significant (See Figure 5-15).

Results for hypothesis 4.3

Hypothesis 4.3 asserted that when the voice is unfamiliar, the three-dimensional learning efficiency (3D-E) of students who heard a voice belonging to a gender identical to theirs would be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the 3D efficiency of students who heard a voice belonging to a gender identical to theirs *vis-à-vis* students who heard a voice belonging to a different gender. The following results were obtained:

- Using ***Multivariate Tests,*** it was found that there was a significant interaction between the familiarity with the NVSC narrator and the similarity of narrator's gender to that of the student Pillai's Trace=0.056 , MF(2,361)=10.717, P<0.001, Partial η^2=0.056.
- In ***Tests of Between-Subjects Effects*** for the interaction between voice level of familiarity and gender similarity, for testing the 3D learning efficiency in the recall test (3D-E-Rec), a significant impact was found; F(1,362)=7.925, P<0.01, Partial η^2=0.021.
- Using the ***Bonferroni post hoc test for pairwise comparisons***, the following results were obtained: the 3D-E-Rec score among students who heard an unfamiliar voice of the same gender (M=0.106) was significantly higher (p<0.01(than students who were exposed to an unfamiliar voice of a different gender (M=-0.627(. No significant difference (p>0.05(in the 3D-E-Rec score was found between students who were exposed to a familiar voice of the same gender (M=0.325(and students who were exposed to a familiar voice of different gender (M=0.407) see Table 5-9.
- Testing the interaction between voice familiarity and gender similarity for the 3D learning efficiency in the transfer test (3D-E-Trn) found no significant interaction; F(1,362)=0.771, P>0.05 , Partial η^2=0.002. See Figure 5-16 and Figure 5-17, which demonstrate the differences between the groups of the three-dimensional learning efficiency in recall and transfer task, with familiar and unfamiliar voice.

Thus, **hypothesis 4.3** was only partially confirmed. In other words, studying with a NVSC with an unfamiliar narrator of the same gender as the student's, resulted in higher three-dimensional learning efficiency (see section 3.1.4) than with an unfamiliar narrator of a different gender only in the recall task. Gender similarity (see section 3.6.1) had no influence in both types of task when the narrator was familiar.

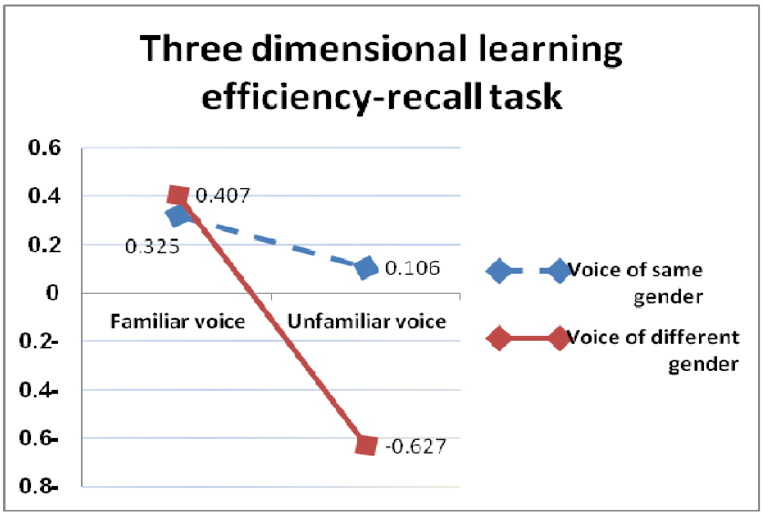

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Figure 5-16: Voice familiarity and gender similarity-three dimensional efficiency in recall test (3D-E-Rec) -Marginal means

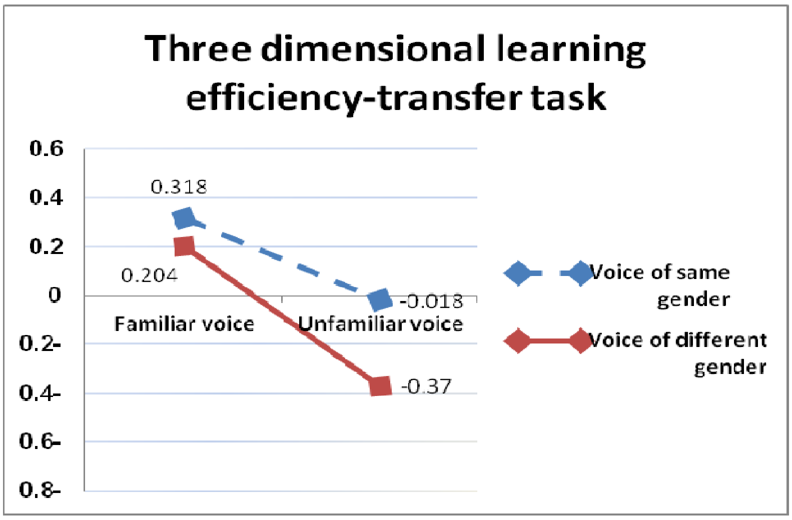

Figure 5-17: Voice familiarity and gender similarity-three dimensional efficiency in transfer test (3D-E-Trn) -Marginal means

In both figures, it is shown that in general, the three-dimensional learning efficiency of the group of the same gender voice was higher than that of the group of a different gender voice. It is shown, that with a familiar voice there was no significant difference between the groups, but when shifting to the unfamiliar voice it is shown that there was a significant difference in the recall test between the groups and the group of the same gender voice showed higher efficiency than that of the group of a different gender voice.

Results for hypothesis 5

Hypothesis 5 asserted that when the voice is unfamiliar, the degree of motivation on task performance (MT) of students who heard a voice belonging to an identical gender would be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the degree of motivation for task performance (MT) with students who heard a voice belonging to identical gender *vis-à-vis* students who heard a voice belonging to a different gender. The following table demonstrates the results that were obtained:

Table 5-10: Voice familiarity and gender similarity-raw and marginal means of motivation on task index

			MT			
			N	Raw mean (SD)	Marginal mean (SE)	$F^{(DF)}$
Recall task	Familiar Voice	Same gender	99	-0.005 (0.495)	-0.024 (0.058)	3.224* (1,362)
		Different gender	73	-0.083 (0.524)	-0.037 (0.067)	
	Unfamiliar Voice	Same gender	94	-0.059 (0.465)	-0.072 (0.059)	
		Different gender	106	0.126 (0.750)	0.129 (0.055)	
Transfer task	Familiar Voice	Same gender	99	0.067 (0.583)	0.048 (0.074)	5.646** (1,362)
		Different gender	73	0.134 (0.655)	0.187 (0.086)	
	Unfamiliar Voice	Same gender	94	0.054 (0.782)	0.039 (0.075)	
		Different gender	106	-0.190 (0.878)	-0.187 (0.070)	

*p<0.10, **p<0.05

- Using ***Multivariate Tests,*** it was found that there was a significant interaction between the familiarity with the NVSC narrator and the similarity of narrator's gender to that of the student; Pillai's Trace=0.047, MF(2,361)=8.866, P<0.001, Partial η^2=0.047.
- ***Tests of Between-Subjects Effects*** for the interaction between voice familiarity and gender similarity in testing the MT in the recall test (MT-Rec), only a limited significance was found in the difference between the two groups ; F(1,362)=3.224, P=0.07 , Partial η^2=0.009.
- A Significant interaction between voice level of familiarity and gender similarity was found in the transfer test (MT-Trn); F(1,362)=5.646, P<0.05, Partial η^2=0.015.
- Using the ***Bonferroni Post Hoc test for Pairwise Comparisons***, the following results were obtained: No significant difference (p>0.05) was found in the MT-Trn

index between students who were exposed to an unfamiliar voice of the same gender (M=0.039) and students who were exposed to an unfamiliar voice of a different gender (M=-0.187).

- No significant difference (p>0.05(was found between students who were exposed to a familiar voice of the same gender (M=0.048(and students who were exposed to a familiar voice of a different gender (M=0.187 (, see Table 5-10, Figure 5-18 and Figure 5-19 .

(**Note**: The significance of the interaction stemmed from the differences between students who heard a familiar voice of a different gender),M=0.187 (and students who heard an unfamiliar voice of a different gender) M=-0.187 (and not from the differences between same gender and different gender groups among the students who listened to an unfamiliar voice).

Thus, **hypothesis 5** was refuted. In other words, studying with a NVSC with an unfamiliar narrator of the same gender as the student's, resulted in a limited significant lower motivation (see section 3.1.5) than with an unfamiliar narrator of a different gender in the recall task only. Gender similarity (see section 3.6.1) had no influence when the narrator was familiar.

The following figures (Figure 5-18 and Figure 5-19), demonstrate the differences between the groups in relation to the motivation indices on recall and transfer task, with familiar and unfamiliar voice:

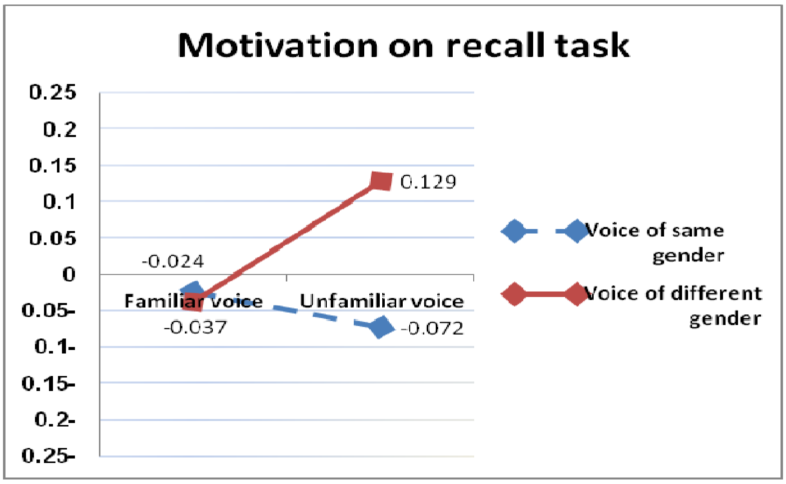

Figure 5-18: Voice familiarity and gender similarity- motivation on task in recall test (MT-Rec) -Marginal means

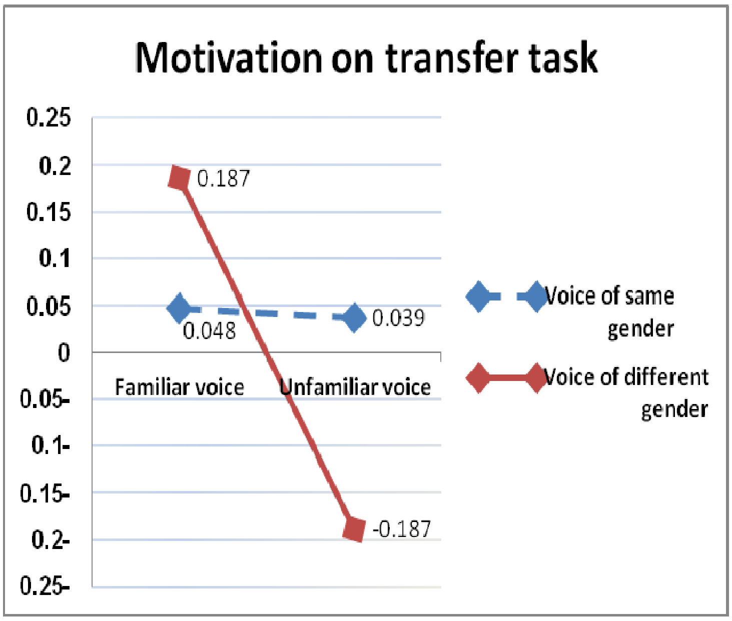

Figure 5-19: Voice familiarity and gender similarity- motivation on task in transfer test (MT-Trn) -Marginal means

Results for hypothesis 6

Hypothesis 6 asserted that when the voice is unfamiliar, the assessment score of the video screen capture (NVSC-A) of students who heard a voice belonging to an identical gender would be higher than that of students who heard a voice belonging to a different gender. When the voice is familiar, no difference will be found in the NVSC-A due to gender similarity/difference. The following table represents the results that were obtained:

Table 5-11: Voice familiarity and gender similarity- raw and marginal means of NVSC assessment

		N	NVSC-A Raw mean $^{(SD)}$	NVSC-A Marginal mean $^{(SE)}$	F $^{(DF)}$
Familiar voice	**Same gender**	106	4.619 $^{(0.837)}$	4.605 $^{(0.078)}$	0.295 $^{(1,372)}$
	Different gender	74	4.705 $^{(0.727)}$	4.709 $^{(0.094)}$	
Unfamiliar voice	**Same gender**	96	4.347 $^{(0.868)}$	4.356 $^{(0.082)}$	
	Different gender	106	4.361 $^{(0.802)}$	4.369 $^{(0.077)}$	

- ***Tests of Between-Subjects Effects*** for the interaction between voice level of familiarity and gender similarity in testing the NVSC-A score, found no significant impact; F(1,372)= 0.295, P>0.05, Partial η^2=0.001, see Figure 5-20, which demonstrates the differences between the groups of the NVSC assessment, with the different voices.

Thus, **hypothesis 6** was refuted. In other words, gender similarity (see section 3.6.1) had no influence on the perceived effectiveness of the MM study materials, both with a familiar and an unfamiliar narrator.

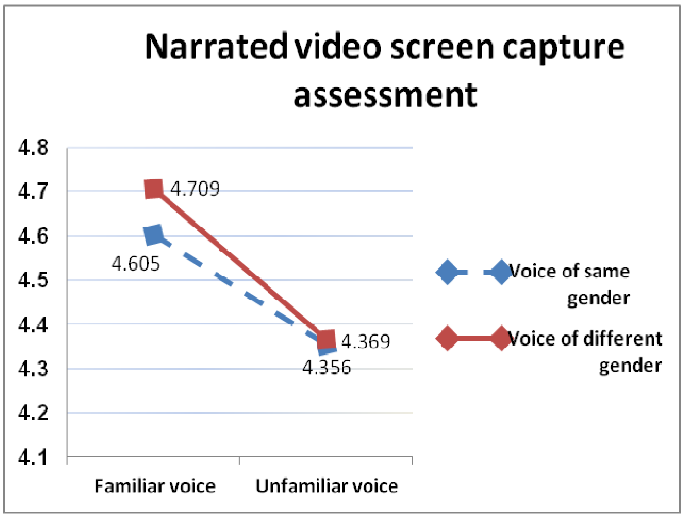

Figure 5-20: Voice familiarity and gender similarity- NVSC assessment scores (NVSC-A) -Marginal means

The above figure demonstrates that in general the group of a different gender voice ranked the NVSCs higher than the group of the same gender voice. Both groups ranked the familiar voice NVSCs higher than the unfamiliar voice NVSCs. However, the difference between the groups was insignificant.

To summarise, one can see that there is an interaction between the level of familiarity with the NVSC's narrator and narrator-student gender similarity and that this interaction affects the learning process efficiency (LPE) and the task efficiency (TE) in the recall test only (LPE-Rec and TE-Rec). Students who were exposed to an unfamiliar voice of the same gender scored higher in the recall task efficiency and their learning process efficiency was higher than students who were exposed to an unfamiliar voice of a different gender. No influence was found on the transfer test and no influence was found on motivation on task (MT) and students' perception of the effectiveness of the NVSC assessment (NVSC-A).

5.1.5 Findings related to hypotheses regarding conscientiousness and voice familiarity

Hypothesis 7 asserted that the influence of **conscientiousness** on the learning efficiency indices would be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

Results for hypothesis 7.1

In testing **hypothesis 7.1** that asserted that the influence of **conscientiousness** on the level of learning process efficiency (LPE) would be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice, the following results were obtained:

- Using ***Multivariate Tests*** for the testing of the interaction between **conscientiousness** and level of familiarity with the narrator's voice, no significant level was found; Pillai's Trace=0.012, $MF(2,361)=2.174$, $P>0.05$, Partial $\eta^2=0.012$.

Thus, **hypothesis 7.1** was refuted. In other words, **conscientiousness** (see section 3.9.1) did not interact with voice familiarity and had no influence on the learning process efficiency.

Results for hypothesis 7.2

In testing **hypothesis 7.2** that asserted that the influence of **conscientiousness** on task performance efficiency (TE) would be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice, the following results were obtained:

- Using ***Multivariate Tests*** for the testing of the interaction between **conscientiousness** and level of familiarity with the narrator's voice, no significant level was found; Pillai's Trace=0.011, $MF(2,361)=2.032$, $P>0.05$, Partial $\eta^2=0.011$.

Thus, **hypothesis 7.2** was refuted. In other words, **conscientiousness** did not interact with voice familiarity and had no influence on the task performance efficiency.

Results for hypothesis 7.3

In testing **hypothesis 7.3** that asserted that the influence of **conscientiousness** on the level of Three-dimensional learning efficiency (3D-E) would be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice, the following results were obtained:

- Using ***Multivariate Tests*** for the testing of the interaction between **conscientiousness** and level of familiarity with the narrator's voice, no significant level was found; Pillai's Trace=0.013, $MF(2,361)=2.373$, $P>0.05$, Partial $\eta^2=0.013$.

Thus, **hypothesis 7.3** was refuted. In other words, **conscientiousness** did not interact with voice familiarity and had no influence on the three dimensional learning efficiency.

Results for hypothesis 7.4

In testing **hypothesis 7.4** that asserted that the influence of **conscientiousness** on the level of motivation for task performance (MT) would be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice, the following results were obtained:

- Using ***Multivariate Tests*** for the testing of the interaction between **conscientiousness** and level of familiarity with the narrator's voice, no significant level was found; Pillai's Trace=0.000, $MF(2,361)=0.001$, $P>0.05$, Partial $\eta^2=0.000$.

Thus, **hypothesis 7.4** was refuted. In other words, **conscientiousness** did not interact with voice familiarity, in relation to the influence on students' motivation on task.

It is worth mentioning that **conscientiousness** was found to have a significant main effect on the motivation on task index (MT); Pillai's Trace=0.021, $MF(2,361)=3.786$, $P<0.05$. Regression coefficients were not significant that is, the impact of **conscientiousness** on motivation on task was non-linear in both recall and transfer test, ($B=-0.068$, $P>0.05$; $B=-0.098$, $P>0.05$, respectively).

To summarise**,** it can be seen that there was no significant interaction between **conscientiousness** and the level of familiarity with the narrator, thus, it cannot be claimed that **conscientiousness** more significantly affects the efficiency and motivation indices when the students are exposed to an unfamiliar voice.

5.1.6 Findings related to hypotheses regarding test-anxiety and voice familiarity

Hypothesis 8 asserted that the influence of **test-anxiety** on the learning and performance efficiency indices would be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

Results for hypothesis 8.1

In testing **hypothesis 8.1** that asserted that the influence of **test-anxiety** on the level of efficiency of the learning process (LPE) would be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice, the following results were obtained:

- Using ***Multivariate Tests*** for the testing of the interaction between **test-anxiety** and level of familiarity with the narrator's voice, no significant level was found; Pillai's Trace=0.001, $MF(2,361)=0.160$, $P>0.050$, Partial $\eta^2=0.001$.

Thus, **hypothesis 8.1** was refuted. In other words, **test-anxiety** (see section 3.9.2) did not interact with voice familiarity and had no influence on the learning process efficiency.

There was, though, a significant main effect of **test-anxiety** on the learning process efficiency Pillai's Trace=0.045, $MF(2,362)=8.570$, $P<0.01$. As the level of anxiety increases, the learning process efficiency decreases in both recall and transfer tests; ($B=-0.288$, $P<0.01$; $B=-0.292$, $P<0.01$, respectively).

Results for hypothesis 8.2

In testing **hypothesis 8.2** that asserted that the influence of **test-anxiety** on the level of task performance efficiency (TE) would be higher among students who heard an unfamiliar voice *vis-à-vis* students who heard a familiar voice, the following results were obtained:

- Using ***Multivariate Tests*** for the testing of the interaction between **test-anxiety** and the level of familiarity with the narrator's voice, no significant level was found; Pillai's Trace=0.005, $MF(2,361)=0.892$, $P>0.05$, Partial $\eta^2=0.005$.

Thus, **hypothesis 8.2** was refuted. In other words, **test-anxiety** did not interact with voice familiarity and had no influence on the task performance efficiency.

There was, though, a significant main effect of **test-anxiety** on task efficiency. Pillai's Trace=0.030, $MF(2,361)=5.601$, $P<0.01$. As the level of anxiety increases, task efficiency decreases in both recall and transfer tests. ($B=-0.273$, $P<0.01$; $B=-0.280$, $P<0.01$, respectively).

Results for hypothesis 8.3

In testing **hypothesis 8.3** that asserted that the influence of **test-anxiety** on the level of three-dimensional learning efficiency (3D-E) would be greater among students who heard an unfamiliar voice *vis-à-vis* students who heard a familiar voice, the following results were obtained:

- Using ***Multivariate Tests*** for the testing of the interaction between **test-anxiety** and level of familiarity with the narrator's voice, no significant level was found; Pillai's Trace=0.002, $MF(2,361)=0.319$, $P>0.05$, Partial $\eta^2=0.002$.

Thus, **hypothesis 8.3** was refuted. In other words, **test-anxiety** did not interact with voice familiarity in relation to the influence on the three dimensional learning efficiency.

There was, though, a significant main effect of **test-anxiety** on three-dimensional learning efficiency. Pillai's Trace=0.044, $MF(2,362)=8.405$, $P<0.01$. As the level of anxiety increases, 3D-Edecreases in both recall and transfer tests, ($B=-0.325$, $P<0.01$; $B=-0.331$, $P<0.01$, respectively).

Results for hypothesis 8.4

In testing **hypothesis 8.4,** which asserted that the influence of **test-anxiety** on the motivation for task performance (MT) would be greater among students who heard an unfamiliar voice *vis-à-vis* students who heard a familiar voice, the following results were obtained:

- Using ***Multivariate Tests*** for the testing of the interaction between **test-anxiety** and level of familiarity with the narrator's voice, no significant level was found; Pillai's Trace=0.004, $MF(2,361)=0.673$, $P>0.050$, Partial $\eta^2=0.004$.

Thus, **hypothesis 8.4** was refuted. In other words, **test-anxiety** did not interact with voice familiarity and had no influence on the students' motivation on task.

In summation, it can be seen that there is no significant interaction between **test-anxiety** and the level of familiarity with the narrator's voice, thus, it cannot be claimed that **test-anxiety** more significantly affects the efficiency and motivation indices when the students are exposed to an unfamiliar voice. There was a main effect of **test-anxiety** on the efficiency indices only.

Following is Table 5-12 which summarises the conclusions of the hypotheses:

Table 5-12: Summary of the findings in relation to the research hypotheses

	Learning Process Efficiency-recall test (LPE-Rec)	Learning Process Efficiency-transfer test (LPE-Trn)	Task Efficiency-recall test (TE-Rec)	Task Efficiency-transfer test (TE-Trn)	Three Dimensional Learning Efficiency-recall test (3D-E-Rec)	Three Dimensional Learning Efficiency-transfer test (3D-E-Trn)	Motivation on Task-recall test (MT-Rec)	Motivation on Task-transfer test (MT-Trn)	Narrated Video Screen Capture Assessment (NVSC-A)
Hypothesis	**H1.1**		**H1.2**		**H1.3**		**H2**		**H3**
Voice Familiarity	+	+	+	+*	+	+	—	+	+
Hypothesis	**H4.1**		**H4.2**		**H4.3**		**H5**		**H6**
Voice Familiarity X Gender Similarity	+	+	+	—	+	—	+*	—	—
Hypothesis	**H7.1**		**H7.2**		**H7.3**		**H7.4**		
Voice Familiarity X Conscientiousness	—	—	—	—	—	—	—	—	
Hypothesis	**H8.1**		**H8.2**		**H8.3**		**H8.4**		
Voice Familiarity X Test-Anxiety	—	—	—	—	—	—	—	—	

* Limited significance, +confirmed, -refuted,

5.2 Qualitative corroborative findings of the semi-structured interviews

During the first phase of the research, when quantitative data were collected, the students were not aware of the research focus. Thus, the purpose of conducting the semi-structured interviews was to find out whether familiarity with the narrator should be regarded as an issue the students perceive as important and if so, check it further in a close-ended follow-up questionnaire for corroboration. In the course of the interviews, it became apparent that opinions were divided – some felt it did not matter at all, or at least they could easily get used to an unfamiliar voice: '…If I was sitting at home and studying alone with the help of recordings it would not really make a difference' (Appendix T Interview I). However, others claimed that there was a significance to a familiarity with the voice of the narrator and that it was important for them to hear their teacher's familiar voice, because it gave them a sense of security, by enabling them to experience the lesson anew, thus, helping them in the learning process: '…when I heard the man I lost concentration and so I feel that it affected the grade I got on the exercise' (Appendix T Interview II).

The Qualitative data collected from the interviews were coded using content analysis (see section 4.11.2), in order to find information about how students perceived the NVSCs. During the interviews, students were free to relate to any aspect of the NVSCs. However, since the interview's main focus was the differential attitude toward voice familiarity, when the students did not relate to that aspect on their own, a direct question was asked whether it mattered if the voice was familiar or not.

The following table summarises the categories coded from the interviews (Appendix T) and the frequency of the statements articulated by the students. These statements set the basis for the follow-up questionnaire (Appendix O):

Table 5-13: Categories and statements from the semi-structured interviews

Categories	Statements	N
Cognitive aspects (N†=178)	Easy to understand	35
	Very focused	37
	Helps to concentrate	10
	Not enough examples	5
	It was helpful that you could listen more than once	18
	Can stop and practise whenever you want	14
	Lack of accompanying written text	1
	Watching the video screen captures is very helpful	37
	Note-taking while watching was necessary	17
	Watching NVSCs is more useful than reading text	4
Social aspects (N†=45)	Feeling that the explanation was personally directed	3
	Prefers watching the NVSCs on learning face to face	4
	Prefers face to face learning in class	33
	You cannot ask questions	5
Technical aspects (N†=39)	Audio problems	1
	Video problems	3
	A background music is missing	1
	You can watch a recording at any time	34
Familiarity with the narrator (N†= 37)	I prefer a familiar voice	16
	It doesn't matter	20
	I prefer various narrators	1

† Total number of statements in the category

Table 5-13 shows that 21 different statements were derived from the interviews. The statements were divided into four categories: (1) cognitive aspects; (2) social aspects; (3) technical aspects; (4) familiarity with the narrator.

Out of 299 statements 178 (59%) belong to the cognitive aspect, 45 (15%) belong to the social aspect, 39 (13%) belong to the technical aspect, 37 (12%) belong to the familiarity with narrator.

If we look at the different categories, in the cognitive aspect (178 statements): 155 (87%) statements attributed positive characteristics to the NVSC and 23 (13%) attributed negative characteristics to the NVSC.

In relation to the social aspect (45 statements): 4 statements (8%) prefer learning via NVSC instead of face-to-face learning, 33 (73%) prefer face-to-face learning and 5 (11%) related to the lack of real interaction with the virtual instructor.

In relation to the technical aspect (39 statements): 34 statements (87%) attributed positive characteristics to the NVSC and 5 (13%) attributed negative characteristics to it.

When relating to the issue of familiarity with the narrator, 16 students (43%) stated that they prefer a familiar voice, 1 student (3%) said that she prefers various voices and 20 students (54%) stated that they have no preference.

5.3 Quantitative corroborative findings of the follow-up questionnaire

The statements that were extracted from the semi-structured interviews informed the formatting of the follow-up questionnaire (Appendix O). In order to analyse the follow-up questionnaire, a simple ***Frequencies*** analysis was conducted for question no. 1 and a ***Frequency for Multiple response*** tests were conducted for questions no. 2 and no. 3. The number of students who participated in the first phase of the research, i.e. the quasi experiments, was 382 and since not all the students who responded to Questions no. 1, 2 and 3 took part in the experiments only those who did, were included in the data analysis.

Question no. 1:

Question no.1 was 'From your point of view, is there any importance to the choice of the narrator in the video screen capture'? The number of respondents who also took part in the experimental phase was 365 (95% out of the 382 who participated in the experimental phase). The following table represents students' responses:

Table 5-14: Findings for question no. 1 of the follow-up questionnaire

	Frequencies	**Percentage of respondents**
A1.It is important that it be the voice of the lecturer one knows	205	56.16%
A2.It does not matter whose voice it is	160	43.83%
Total	365	100%

Table 5-14 shows that 56.16% stated that a familiar voice is important to them, while 43.83% stated that it made no difference to them

Question no. 2:

Question no. 2 was: 'When the voice in the video screen capture is unfamiliar', (students could select more than one answer).

Findings

The number of respondents that also took part in the experimental phase was 340 (89% out of the 382 who participated in the experimental phase). The number of responses was 667 with the average of 1.96 responses per respondent. The following table represents students' responses:

Table 5-15: Findings for question no. 2 of the follow-up questionnaire

		Responses	Percentage of all responses	Percentage of respondents
A1.	**I have an unpleasant feeling**	78	11.70%	22.90%
A2.	**I have a pleasant feeling**	10	1.50%	2.90%
A3.	**I cannot concentrate**	118	17.70%	34.70%
A4.	**It helps me concentrate**	7	1.00%	2.10%
A5.	**I have to hear the video screen capture a few times in order to understand the explanations**	120	18.00%	35.30%
A6.	**I find it easy to understand the explanations**	2	0.30%	0.60%
A7.	**It may help me do the exercises/examination better**	11	1.60%	3.20%
A8.	**It may make me do the exercises/examination less well**	18	2.70%	5.30%
A9.	**I try to imagine how the lecturer looks**	54	8.10%	15.90%
A10.	**I try to guess the personality of the lecturer**	17	2.50%	5.00%
A11.	**I have the feeling of interaction with the lecturer even though one does not actually see him**	14	2.10%	4.10%
A12.	**I feel confident that the material is okay**	17	2.50%	5.00%
A13.	**I feel that the explanations are being directed at me personally**	28	4.20%	8.20%
A14.	**It does not matter to me only if the subject is easy**	46	6.90%	13.50%
A15.	**It does not matter to me in general**	116	17.40%	34.10%
A16.	**It is preferable because it varies the learning**	11	1.60%	3.20%
Total		667	100%	196.2%†
Total attribution of negative influence to an unfamiliar voice (A1, A3, A5, A8, A9, A10)			60.70%	
Total attribution of neutral influence to an unfamiliar voice (A14, A15)			24.30%	
Total attribution of positive influence to an unfamiliar voice (A2, A4, A6, A7, A11, A12, A13, A16)			14.80%.	

† 196.20% means that the mean number of answers per student was 1.96

Table 5-15 for question no. 2 shows that when referred to an unfamiliar narrator most of the students reported a negative reaction. The column titled 'Percentage of all respondents' indicates the percentage of students that checked each of the statements. Since more than one statement could be checked, the total of 196.20% indicates that the mean number of statements selected by one student was 1.96. The column titled 'Percentage of all responses' indicates the percentage that each statement constituted of all the selected responses.

On isolating the items in question no. 2 relating to the effect that hinders learning – A1, A3, A5, A8, A9 and A10 – it is seen that these statements constituted 60.70% of the selected responses.

The items in question no. 2 that attest to a neutral attitude are A14 and A15 and they constituted 24.30% of the responses.

The items in question no. 2 that relate to the positive characteristics of an unfamiliar voice are A2, A4, A6, A7, A11, A12, A13 and A16 and these statements constituted 14.80%.of the selected responses.

Question no. 3:

Question no. 3 was; 'When the voice in the video screen capture is that of a lecturer you know' (students could select more than one answer).

Findings

The number of respondents that also took part in the experimental phase was 359 (94% out of 382). The number of responses was 1345 with the average of 3.74 responses per respondent.

The following table represents students' responses:

Table 5-16: Findings for question no. 3 of the follow-up questionnaire

		Responses	Percentage of all responses	Percentage of respondents
A1.	I have an unpleasant feeling	8	0.60%	2.20%
A2.	I have a pleasant feeling	260	19.30%	72.40%
A3.	I cannot concentrate	0	0%	0%
A4.	It helps me concentrate	174	12.90%	48.50%
A5.	I have to hear the video screen capture a few times in order to understand the explanations	10	0.70%	2.80%
A6.	I find it easy to understand the explanations	106	7.90%	29.50%
A7.	It may help me do the exercises/examination better	70	5.20%	19.50%
A8.	It may make me do the exercises/examination less well	8	0.60%	2.20%
A9.	I have the feeling of interaction with the lecturer even though one does not actually see him	125	9.30%	34.80%
A10.	I feel as though I am in the class with the lecturer standing in front of me	176	13.10%	49.00%
A11.	I imagine the lecturer giving explanations	106	7.90%	29.50%
A12.	I feel confident that the material is okay	184	13.70%	51.30%
A13.	I feel that the explanations are being directed at me personally	50	3.70%	13.90%
A14.	It does not matter to me	68	5.10%	18.90%
Total		1345	100%	374.7%†
Total attribution of negative influence to a familiar voice (A1, A3, A5, A8)			1.9%	
Total attribution of neutral influence to a familiar voice (A14)			5.10%	
Total attribution of positive influence to a familiar voice (A2, A4, A6, A7, A9, A10, A11, A12, A13)			93%	

†374.70% means that the mean number of answers per student was 3.74

The column titled 'Percentage of all respondents' indicates the percentage of students that checked each of the statements. Since more than one statement could be checked, the total of 374.70% indicates that the mean number of statements selected by one student was 3.74. The column titled 'Percentage of all responses' indicates the percentage that each statement constituted of all the selected responses.

As can be seen in Table 5-16, the items in question no. 3 that attribute a positive influence to a familiar voice are A2, A4, A6, A7, A9, A10, A11, A12, A13 and these statements constituted 93% of the selected responses.

The items in question no. 3 that attribute a negative influence to a familiar voice are A1, A3, A5, A8 and these statements constituted 1.9% of the selected responses.

The item in question no. 3 that attests to a neutral attitude to the narrator's voice is A14 and these statements constituted 5.10% of the selected responses.

5.3.1 Findings of the learning efficiency in relation to the voice preference

The research hypotheses dealt with the question of whether there is an influence of the familiarity with the narrator on students' learning efficiency. The data obtained in the follow-up questionnaire (Appendix O) shed more light on students' perception regarding familiarity with the narrator; in particular, question no. 1, which demonstrated students' articulated voice preference, was of special interest.

Thus, data collected in question no. 1, which indicate students' preference, was tested in relation to voice-familiarity, in order to investigate the relation between the voice preference of the students and their cognitive load, performance and eventually on their learning efficiency indices and NVSC assessment, when encountering a voice that matches their preference and when the voice does not match their preference. Thus, this reveals if students have the ability to 'predict' whether listening to an unfamiliar voice would have a negative influence on their learning.

Table 5-17 and Table 5-18, which follow, show means and mean differences of students who were exposed to the different narrators in relation to their preferences. The SPSS output of the T-Test analysis is shown in Appendix W.

Table 5-17: Cognitive load and performance measures in relation to students' preferences (T-Test)

		Cognitive load-learning Mean$^{(SD)}$	Cognitive load on recall task Mean$^{(SD)}$	Cognitive load on transfer task Mean$^{(SD)}$	Performance on recall task Mean$^{(SD)}$	Performance on transfer task Mean$^{(SD)}$
Prefers a familiar voice	**Familiar voice**	4.46 $^{(1.87)}$	4.61 $^{(1.8)}$	6.17 $^{(1.86)}$	80.29 $^{(13.54)}$	77.51 $^{(15.55)}$
	Unfamiliar voice	5.4 $^{(1.76)}$	5.46 $^{(2.01)}$	6.24 $^{(2.07)}$	75.33 $^{(18.64)}$	70.17 $^{(22.82)}$
	Mean difference 95% Confidence Interval of the Difference- (Lower, Upper)	-0.94*** (-1.44, -0.44)	-0.85*** (-1.38, -0.32)	-0.07 (-0.62, 0.48)	4.96** (0.47, 9.45)	7.34*** (1.96, 2.72)
No preference	**Familiar voice**	4.03 $^{(1.75)}$	4.74 $^{(1.83)}$	6.01 $^{(1.99)}$	81.91 $^{(13.57)}$	79.43 $^{(14.6)}$
	Unfamiliar voice	5.16 $^{(1.65)}$	5.32 $^{(2.11)}$	6.15 $^{(1.88)}$	79.04 $^{(15.19)}$	75.92 $^{(19.79)}$
	Mean difference 95% Confidence Interval of the Difference- (Lower, Upper)	-1.14*** (-1.68, -0.59)	-0.58* (-1.21, 0.057)	-0.14 (-0.76, 0.48)	2.88 (-1.76, 7.52)	3.52 (-2.14, 9.17)

*p<0.10, **p<0.05, ***p<0.01. (sig. 2-tailed)

Table 5-17 shows that the cognitive load during the learning phase of students who preferred a familiar voice and were exposed to a familiar voice was lower (M=4.46) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=5.4). The mean difference between the two measures of cognitive load was significant, (MD=-0.94, $p<0.01$).

The cognitive load during the learning phase of students who had no preference and were exposed to a familiar voice was lower (M=4.03) than that of students who had no preference and were exposed to an unfamiliar voice (M=5.16). The mean difference between the two measures of cognitive load was significant, (MD=-1.14, $p<0.01$).

The cognitive load during the recall task phase of students who preferred a familiar voice and were exposed to a familiar voice was lower (M=4.61) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=5.46). The mean difference between the two measures of cognitive load was significant, (MD=-0.85, $p<0.01$).

The cognitive load during the recall task phase of students who had no preference for a particular voice and were exposed to a familiar voice was lower (M=4.74) than that of students who did not have a preference for either kind of voice and were exposed to an unfamiliar voice (M=5.32). The mean difference between the two measures of cognitive load was significant, (MD=-0.58, $p<0.10$).

The cognitive load during the transfer task phase of students who preferred a familiar voice and were exposed to a familiar voice was lower (M=6.17) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=6.24). However, the mean difference between the two measures of cognitive load was not significant (MD=-0.07, $p>0.10$).

The cognitive load during the transfer task phase of students who had no preference and were exposed to a familiar voice was lower (M=6.01) than that of students who had no preference and were exposed to an unfamiliar voice (M=6.15). However, the mean difference between the two measures of cognitive load was not significant (MD=-0.14, $p>0.10$)

The performance on the recall task of students who preferred a familiar voice and were exposed to a familiar voice was higher (M=80.29) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=75.33). The mean difference between the two measures of cognitive load was significant (MD=4.96, p<0.05).

The performance in the recall task phase of students who had no preference and were exposed to a familiar voice was higher (M=81.91) than that of students who did not have any preference and were exposed to an unfamiliar voice (M=79.04). However, the mean difference between the two measures of cognitive load was not significant (MD=2.88, p>0.10).

The performance in the transfer task of students who preferred a familiar voice and were exposed to a familiar voice was higher (M=77.51) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=70.17). The mean difference between the two measures of cognitive load was significant (MD=7.34, p<0.01).

The performance in the transfer task phase of students who had no preference and were exposed to a familiar voice was higher (M=79.43) than that of students who had no preference and were exposed to an unfamiliar voice (M=75.92). However, the mean difference between the two measures of cognitive load was not significant (MD=3.52, p>0.10).

Following is Table 5-18, which details the efficiency and motivational indices in relation to students' preferences:

Table 5-18: Learning efficiency and motivation on task indices in relation to students' preferences (T-Test)

		LPE-Rec Mean$^{(SD)}$	LPE-Trn Mean$^{(SD)}$	TE-Rec Mean$^{(SD)}$	TE-Trn Mean$^{(SD)}$	3D-E-Rec Mean$^{(SD)}$	3D-E-Trn Mean$^{(SD)}$	MT-Rec Mean$^{(SD)}$	MT-Trn Mean$^{(SD)}$
Prefers a familiar voice	**Familiar voice**	0.18 (1.23)	0.2 (1.16)	0.21 (1.16)	0.08 (1.1)	0.27 (1.41)	0.18 (1.35)	-0.09 (0.52)	0.1 (0.59)
	Unfamiliar voice	-0.4 (1.36)	-0.43 (1.34)	-0.32 (1.4)	-0.24 (1.29)	-0.45 (1.55)	-0.38 (1.44)	-0.02 (0.72)	-0.16 (0.96)
	Mean difference 95% Confidence Interval of the Difference- (Lower, Upper)	0.59*** (0.23, 0.95)	0.64*** (0.29, 0.99)	0.53*** (0.18, 0.89)	0.31* (-0.02, 0.65)	0.73*** (0.32, 1.14)	0.56*** (0.17, 0.95)	-0.79 (-0.25, 0.097)	0.27** (0.05, 0.48)
No preference	**Familiar voice**	0.43 (1.13)	0.44 (1.03)	0.24 (1.17)	0.19 (1.11)	0.44 (1.32)	0.4 (1.23)	0.02 (0.5)	0.1 (0.64)
	Unfamiliar voice	-0.14 (1.13)	-0.13 (1.14)	-0.1 (1.35)	0.01 (1.27)	-0.2 (1.43)	-0.11 (1.31)	0.1 (0.52)	0.02 (0.65)
	Mean difference 95% Confidence Interval of the Difference- (Lower, Upper)	0.57*** (0.20, 0.93)	0.57*** (0.22, 0.92)	0.34 (-0.07, 0.75)	0.18 (-0.20, 0.57)	0.63*** (0.19, 1.08)	0.51** (0.1, 0.91)	-0.77 (-0.24, 0.09)	0.08 (-0.13, 0.29)

* p<0.10, **p<0.05, ***p<0.01. (sig. 2-tailed)

Table 5-19 shows that the learning process efficiency during the recall task (LPE-Rec) of students who preferred a familiar voice and were exposed to a familiar voice was higher (M=0.18) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=-0.4). The mean difference between the two measures of learning process efficiency was significant, (MD=0.59, p<0.01).

The learning process efficiency during the recall task (LPE-Rec) of students who have no preference for a particular voice and were exposed to a familiar voice was higher (M=0.43) than that of students who did not have a preference for either kind of voice and were exposed to an unfamiliar voice (M=-0.14). The mean difference between the two measures of learning process efficiency was significant (MD=0.57, p<0.01), see Figure 5-21, which demonstrates the differences between the groups of the learning process efficiency indices in the recall task in relation to students' voice preference, with familiar and unfamiliar voice:

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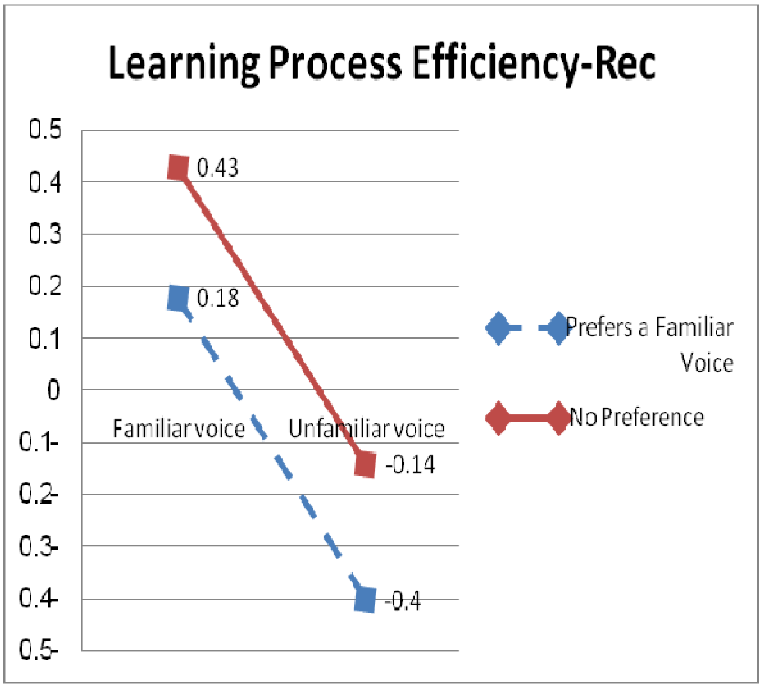

Figure 5-21 : LPE-Rec in relation to voice familiarity and students' preferences

The learning process efficiency during the transfer task (LPE-Trn) of students who preferred a familiar voice and were exposed to a familiar voice was higher (M=0.2) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=-0.43). The mean difference between the two measures of learning process efficiency was significant, (MD=0.64, p<0.01).

The learning process efficiency during the transfer task (LPE-Trn) of students who had no preference for a particular voice and were exposed to a familiar voice was higher (M=0.44) than that of students who did not prefer either kind of voice and were exposed to an unfamiliar voice (M=-0.13). The mean difference between the two measures of learning process efficiency was significant, (MD=0.57, p<0.01) see Figure 5-22, which demonstrates the differences between the groups of the learning process efficiency indices in the transfer task in relation to voice preference, with familiar and unfamiliar voice:

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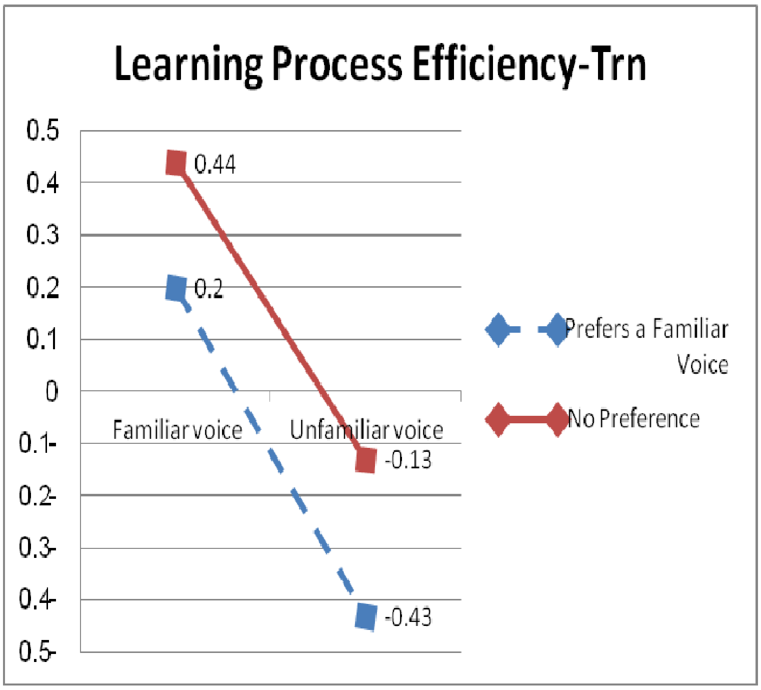

Figure 5-22 : LPE-Trn in relation to voice familiarity and students' preferences

Table 5-18 shows that the task efficiency during the recall task (TE-Rec) of students who preferred a familiar voice and were exposed to a familiar voice was higher (M=0.21) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=-0.32). The mean difference between the two measures of task efficiency was significant, (MD=0.53, p<0.01).

The task efficiency during the recall task (TE-Rec) of students who have no preference for a particular voice and were exposed to a familiar voice was higher (M=0.24) than that of students who do not have a preference for either kind of voice and were exposed to an unfamiliar voice (M=-0.1). However, the mean difference between the two measures of task efficiency was not significant, (MD=0.34, p>0.10), see Figure 5-23 , which demonstrates the differences between the groups of the task efficiency indices in the recall task in relation to voice preference, with familiar and unfamiliar voice:

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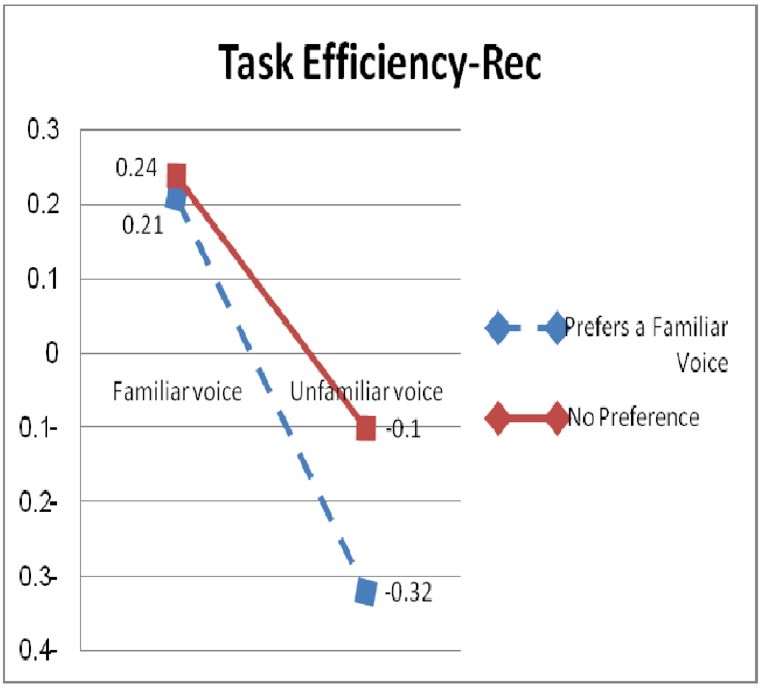

Figure 5-23: TE-Rec in relation to voice familiarity and students' preferences

The task efficiency during the transfer task (TE-Trn) of students who preferred a familiar voice and were exposed to a familiar voice was higher (M=0.08) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=-0.24). The mean difference between the two measures of task efficiency was significant, (MD=0.31, p<0.1).

The task efficiency during the transfer task (TE-Trn) of students who do not prefer a particular voice and were exposed to a familiar voice was higher (M=0.19) than that of students who do not prefer either kind of voice and were exposed to an unfamiliar voice (M=0.01). The mean difference between the two measures of task efficiency was not significant, (MD=0.18, p>0.10), see Figure 5-24 , which demonstrates the differences between the groups of the task efficiency indices in the transfer task in relation to voice preference, with familiar and unfamiliar voice:

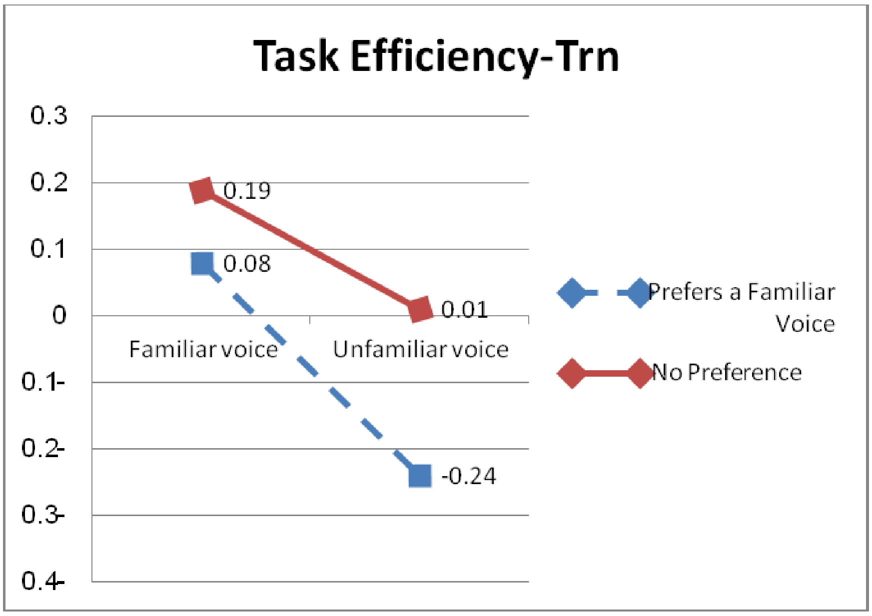

Figure 5-24: TE-Trn in relation to voice familiarity and students' preferences

It can be seen in Table 5-18 that the three-dimensional learning efficiency during the recall task (3D-E-Rec) of students who preferred a familiar voice and were exposed to a familiar voice was higher (M=0.27) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=-0.45). The mean difference between the two measures of the three-dimensional learning efficiency was significant (MD=0.73, p<0.01).

The three-dimensional learning efficiency during the recall task (3D-E-Rec) of students who had no preference and were exposed to a familiar voice was higher (M=0.44) than that of students who had no preference and were exposed to an unfamiliar voice (M=-0.2). The mean difference between the two measures of the three-dimensional learning efficiency was significant, (MD=0.63, p<0.01), see Figure 5-25, which demonstrates the differences between the groups of the three dimensional learning efficiency indices in the recall task in relation to voice preference:

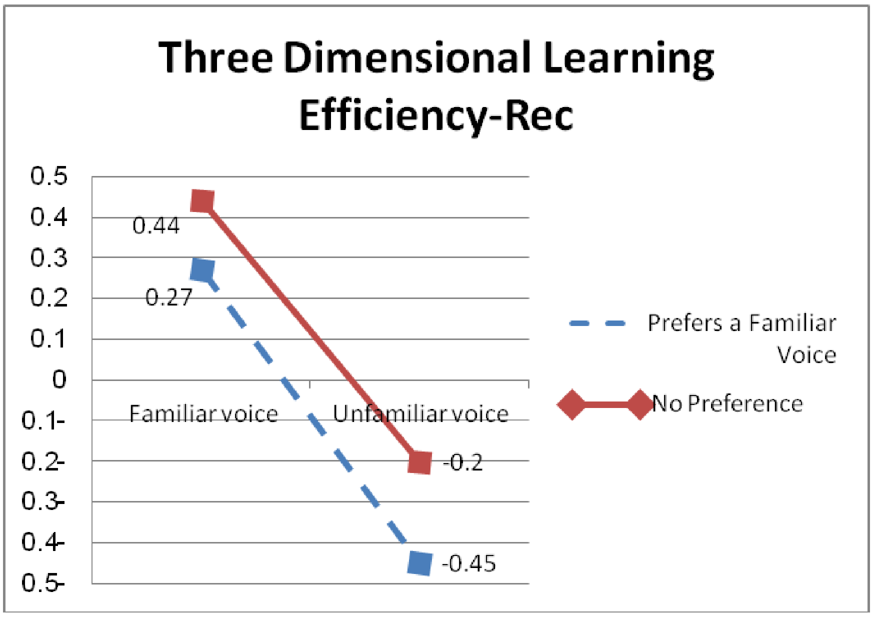

Figure 5-25: 3D-E-Rec in relation to voice familiarity and students' preferences

The three-dimensional learning efficiency during the transfer task (3D-E-Trn) of students who preferred a familiar voice and were exposed to a familiar voice was higher (M=0.18) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=-0.38). The mean difference between the two measures of the three-dimensional learning efficiency was significant (MD=0.56, p<0.01).

The three-dimensional learning efficiency during the transfer task (3D-E-Trn) of students who had no preference and were exposed to a familiar voice was higher (M=0.4) than that of students who had no preference and were exposed to an unfamiliar voice (M=-0.11). The mean difference between the two measures of the three-dimensional learning efficiency was significant, (MD=0.51, p<0.05), see Figure 5-26 , which demonstrates the differences between the groups of the three dimensional learning efficiency indices in the transfer task in relation to voice preference, with familiar and unfamiliar voice:

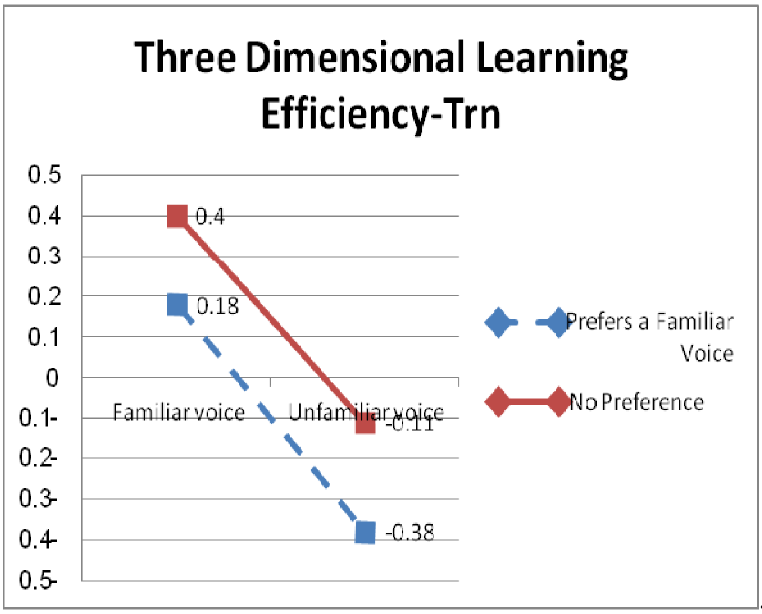

Figure 5-26: 3D-E-Trn in relation to voice familiarity and students' preferences

Table 5-18 shows that the motivation during performance of the recall task (MT-Rec) of students who preferred a familiar voice and were exposed to a familiar voice was lower (M=-0.09) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=-0.02). However, the mean difference between the two measures of the motivation during performance was not significant (MD=-0.79, p>0.10).

The motivation during performance of the recall task (MT-Rec) of students who had no preference and were exposed to a familiar voice was lower (M=0.02) than that of students who had no preference and were exposed to an unfamiliar voice (M=0.1). However, the mean difference between the two measures of the three-dimensional learning efficiency was not significant (MD=-0.77, p>0.10), see Figure 5-27, which demonstrates the differences between the groups of the motivation on task indices in the recall task in relation to voice preference, with familiar and unfamiliar voice:

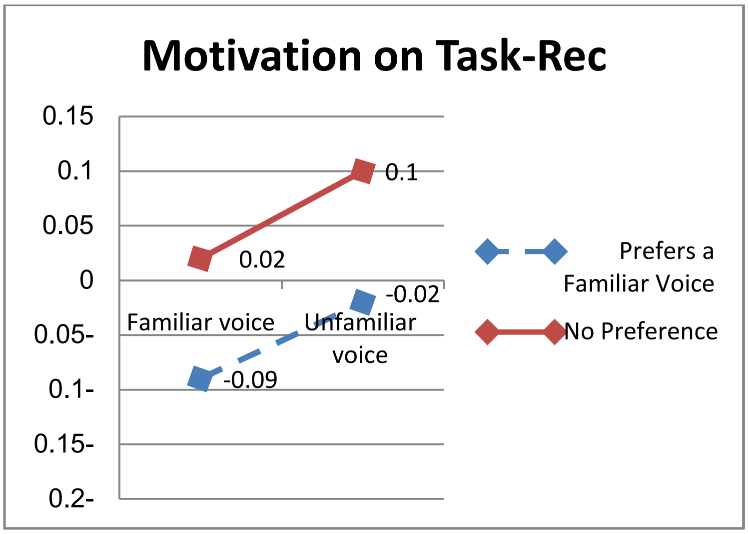

Figure 5-27: MT-Rec in relation to voice familiarity and students' preferences

The motivation during performance of the transfer task (MT-Trn) of students who preferred a familiar voice and were exposed to a familiar voice was higher (M=0.1) than that of students who preferred a familiar voice and were exposed to an unfamiliar voice (M=-0.16). The mean difference between the two measures of the motivation during performance was significant (MD=0.27, p<0.05).

The motivation during performance of the transfer task (MT-Trn) of students who had no preference and were exposed to a familiar voice was lower (M=0.1) than that of students who had no preference and were exposed to an unfamiliar voice (M=0.02). However, the mean difference between the two measures of the three-dimensional learning efficiency was not significant (MD=0.08, p>0.10) see Figure 5-28, which demonstrates the differences between the groups of the motivation on task indices in the transfer task in relation to voice preference, with familiar and unfamiliar voice:

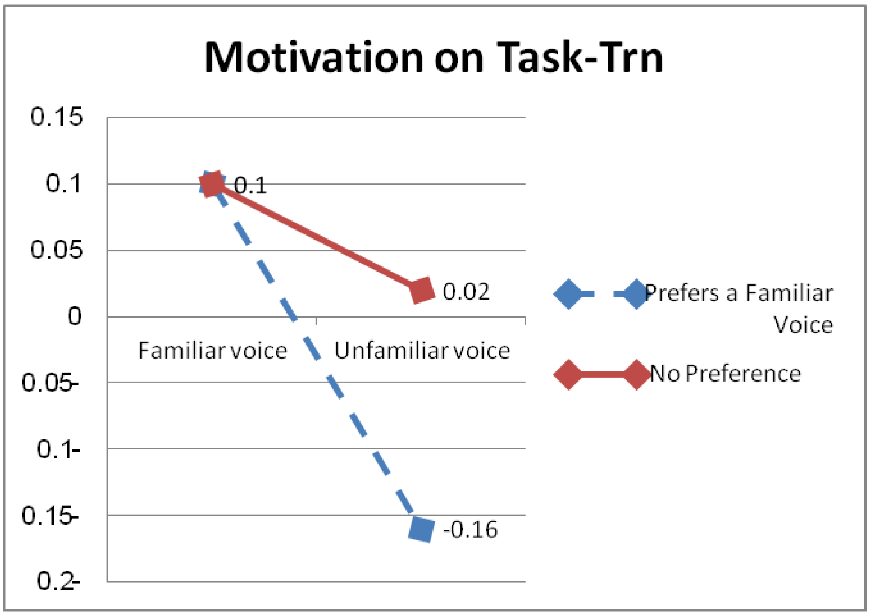

Figure 5-28: MT-Trn in relation to voice familiarity and students' preferences

5.4 Limitations of the Results

The results of the research may be limited by various types of errors; some of them are within any MANOVA or MANCOVA and are unavoidable (Keppel, 1991; Stevens, 2002). In the current study, the Rec and Trn indices of the dependent variables were highly correlated; therefore, the MANCOVA could result in confounded results. However, they were not united or disregarded because they measured different type of task performance (recall *versus* transfer). Thus, they allowed a more detailed look into the overall learning efficiency. As seen in Table 5-5, the assumption of equal variance of MT-Rec and MT-Trn only, was violated and this may disrupt the results related to this index.

Other types of errors are those that stem from the researcher's assessments (Mitchell, Jolley and O'Shea, 2010). In the present research, there might be a systematic error in which the person, who assessed the students' test files, systematically graded them erroneously (Pedhazur and Schmelkin, 1991). Although the assessor used a detailed rubric when assessing the tests and he was blind to the condition in which the tests were performed, errors because of bias or the rubric itself might happen. While on one hand if multiple raters assessed the tests that kind of error might be avoided, on the other hand multiple raters might harm the consistency of the ratings, which, in this research was found to be very high (see section 4.9.2-Inter-observer agreement). The rubric itself might be a source for error and the sort of tests used in the research, might be as well. If, for instance, the researcher used multiple-choice tests, the assessment would have been more accurate because there is only one correct answer for each question. However, the present research environment, i.e. ***Computer Literacy*** Course, did not allow that kind of test.

Another type of error might occur because the research was conducted in the students' natural environment. On one hand, the research design tried to eliminate errors that relate to the artificial experimental research design, on the other hand, students were graded for their test and it was part of their final course grade, which might impose pressure, frustration or motivation.

The present chapter described the findings of the research and summed up which hypotheses were supported and which ones were refuted. Also the corroboration data were described, which were collected via semi-structured interviews and a follow-up questionnaire, which meant to add another perspective to the issue of the influence of familiarity with the narrator. In addition, this chapter dealt with possible limitations of the results, which will be taken into consideration when discussing them in the next chapter.

Chapter 6 - Discussion and conclusions

The purpose of this chapter is to discuss the research results and the way in which they relate to theories on which the research was based. Also presented in this chapter are the study limitations and suggestions for future research.

Stemming from ***Social Agency Theory*** (Moreno, et al., 2001; Mayer, Sobko and Mautone, 2003; Louwerse, et al., 2005), the research sought an answer to the question of whether there is a difference in both the perceived and actual efficiency of learning materials featuring familiar or unfamiliar voices and whether individual differences exhibited by **conscientiousness** and **test-anxiety** have any influence in the matter. Also, in the light of the *Similarity Attraction Principle* (Nass and Lee, 2001; Nass and Brave, 2005; Nass and Yen, 2010), the research tried to find out whether there is any interaction between student-narrator gender similarity and voice familiarity.

The research hypotheses were examined from the perspective of ***Cognitive Load Theory*** (CLT) (Sweller, 1988; Sweller, van Merriënboer and Paas, 1998; Sweller, Ayres and Kalyuga, 2011), the central theory on which the study was based being ***Social Agency Theory***, which claims that in learning from MM learning materials, the more social cues the students receive, the less cognitive load they experience and thus, the more efficient will be their learning. This theory is based on the ***Media Equation Theory*** (Nass and Reeves, 1996), which states that people relate to the computer as to a social partner and that social interaction takes place during the course of learning with the help of the computer. When this interaction is positive, the learners perceive the online teacher as doing his/her utmost to explain the material in the best way possible and in response the learners automatically make their best effort to understand (Mayer, Sobko and Mautone, 2003; Geary, 2007). The assumption in the present research was that when students hear the voice of a lecturer who is known to them from the classroom, that is, they have social interaction and a personal relationship with him/her, they receive more social cues and experience more positive social interaction than students who hear the voice of an unknown lecturer. Thus, in the light of the ***Social Agency Theory***, they will be more motivated to learn, experience less extraneous cognitive load and their learning will be more efficient than that of students who hear the voice of an unknown lecturer. Thus, from cognitive load perspective the assumption was that social cues received from a familiar narrator will allow the students to allocate more WM resources to generative processes and also will cause them less extraneous load, by facilitating automatic activation of social interaction schema and by eliminating unnecessary and irrelevant thoughts regarding the identity of the unknown lecturer.

In order to examine the influence of the lecturer's familiarity on learning, the following dependent variables were examined:

1. Learning efficiency, divided into three indices:
   - Learning Process Efficiency (LPE);
   - Task Efficiency (TE);
   - Three Dimensional Learning Efficiency (3D-E);
2. Motivation on Task (MT);
3. Narrated Video Screen Capture Assessment (NVSC-A);

The independent variables were:

1. Voice familiarity – familiar *versus* unfamiliar voice;
2. Voice familiarity and gender similarity – familiar voice of the same gender as the student's *versus* familiar voice of a different gender than the student's and unfamiliar voice of the same gender as the student's *versus* unfamiliar voice of a different gender than the student's;
3. Conscientiousness;
4. Test-anxiety;

For the purpose of data collection quasi-experiments were conducted, in the course of which the students viewed NVSCs, completed questionnaires and carried out recall and transfer tasks (see Figure 4-3). It is important to remember that at the time of the experiment and data collection, the students were aware of research being conducted and data collected. However, they were not aware of the aims and focus of the research.

In examining the means of cognitive load and the performance grades in the various stages of the experiments (see Table 5-4), it was found that there were significant differences in the cognitive load as reported by the students during the learning process and in recall task: when the students were exposed to a familiar narrator the cognitive load was lower (except for the load in performance of transfer tasks, which will be discussed later). In addition, significant differences were found in the performance of recall and transfer tasks. When the students were exposed to a familiar voice performance was higher. As regards mental effort (which is an indication of cognitive load), the difference between the groups was not significant in the performance of transfer tasks (see Table 5-4), i.e. in terms of effectiveness, if only the performance of the tasks is taken into consideration, it was found that learning through a familiar voice was more effective. However, according to Paas and van Merriënboer (1993) and van Gog and Paas (2008), examination of performance only does not give an accurate picture of the efficiency of learning and the mental effort invested in performance of the task must also be taken into consideration (Paas, Renkl and Sweller, 2003; Paas, et al., 2003; van Gog and Paas, 2008). What the research sought to examine was the efficiency of learning, which takes into account both performance and cognitive load created during performance of the task and learning, since students who have arrived at the same performance results as their colleague but who have invested less mental effort have clearly performed the task more efficiently (Paas, Renkl and Sweller, 2003).

6.1 Discussion related to the research hypotheses

6.1.1 Hypotheses regarding voice familiarity

Hypothesis 1 asserts that the learning and performance efficiency indices of the students who heard a familiar voice will be higher than the learning and performance efficiency indices of students who heard an unfamiliar voice.

Hypothesis 1 was divided into three secondary hypotheses, each of which relates to a different efficiency index.

- H1.1-Learning Process Efficiency (LPE);
- H1.2-Task Efficiency (TE);
- H1.3-Three Dimensional Learning Efficiency (3D-E);

Since the three efficiency indices above derive from the same data set (measurements of cognitive load at different stages and performance of recall and transfer tasks), a high correlation between them would be expected. In any event, the individual indices were examined separately as each provides a somewhat different perspective of the relative efficiency of learning. LPE measures the efficiency of the learning process and allows interpretation of the differences between the various extraneous processes in the different learning conditions; TE measures the efficiency of task performance and allows interpretation related to generative processes (van Gog and Paas, 2008); and 3D-E consolidates the previous two indices and provides a more general picture of learning efficiency (Tuovinen and Paas, 2004). From the point of view of the present research, the more interesting index was LPE, since no manipulation was carried out in terms of the learning method applied with the different groups and the only difference was with respect to the familiarity with the narrator in the different NVSCs – which, in the light of the ***Social Agency Theory***, is supposed to influence the social cues that the students receive during viewing of the NVSC, affect their extraneous load and consequently their learning process efficiency. However, in calculating the different efficiency indices a more detailed picture can be obtained, helping to understand the possible differences between the different learning conditions, indicating not only any influence on the extraneous load but also possible changes in the germane processes (van Gog and Paas, 2008; Sweller, 2010; Mayer, 2011a), in light of the claim made by ***Media Equation Theory*** (Nass and Reeves, 1996) and ***Social Agency Theory*** (Mayer, 2005b), that when experiencing positive social interaction with the computer, students will make more effort to understand. It was therefore interesting to examine, first and foremost, if a familiarity with the narrator's voice has any influence on the efficiency of the learning process (LPE) – which, given learning conditions with an identical intrinsic load, would be affected by changes in extraneous processes – and if so, whether there are any implications regarding the efficiency of subsequent task performance and motivation to do so.

Hypothesis 1.1 asserted that the efficiency of the learning process (LPE) of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice. The following equation was used to calculate the LPE (see Equation 3-2):

$$\mathbf{LPE} = \frac{\boldsymbol{ZTaskPerformance - ZLearningMentalEffort}}{\boldsymbol{\sqrt{2}}}$$

Factual conclusions

According to the means in Table 5-6, it may be seen that the marginal mean of the LPE grade in the recall test (Rec) among students who heard a familiar voice (M=0.303) was significantly higher than among students who heard an unfamiliar voice (M=–0.224), i.e. a familiarity with the narrator's voice was found to have a significant influence on LPE in recall tests.

From Figure 5-1 it may be seen that the LPE-Rec index of the group that was exposed to a familiar voice (E_F) is located in the zone defined as high efficiency according to the model suggested by Paas, Renkl and Sweller (2003), whereas the LPE-Rec index of the group exposed to an unfamiliar voice (E_U) is located in the zone defined as low efficiency.

According to the means in Table 5-6, it may be seen that the marginal mean of the LPE index in the transfer test (Trn) among students who heard a familiar voice (M=0.310) was significantly higher than among students who heard an unfamiliar voice (M=-0.234), i.e. the type of voice was found to have a significant influence on the efficiency of the learning process in transfer tests as well.

From Figure 5-2 it may be seen that the efficiency index (LPE-Trn) of the group that was exposed to a familiar voice (E_F) is located in the zone defined as high efficiency according to Paas, Renkl and Sweller (2003) suggested model (Figure 3-2), whereas the LPE-Trn index of the group exposed to an unfamiliar voice (E_U) is located in the zone defined as low efficiency.

Interpretations and conceptual conclusions

Hypothesis 1.1 was confirmed with respect to both recall and transfer tests and these findings are in line with ***Social Agency Theory***. In accordance with ***Social Agency Theory*** and ***Media Equation Theory***, on which it is based, it was assumed that when the narrator is known, the students will receive more social cues and will experience a more positive social interaction. When the narrator is not known, the assumption was that the students will find it more difficult to activate the social schema in the LTM in order to establish social interaction and will therefore, be busy for part of the time in attempting to interpret the situation from a perspective of a potential social interaction. In accordance with CLT, they are, in fact, busy with cognitive activities that are not relevant to learning, to a greater extent than students who are familiar with the narrator and already have a mental image of him/her. When the narrator is familiar, the students see him/her in their mind's eye, imagine the nature of the interaction with him/her as they know it from the classroom and activate their social schema automatically, leaving them with more resources in the WM to undertake the learning tasks they face. On examining the cognitive load reported by the students (see Table 5-4), it may be clearly seen that the cognitive load during learning reported by the students who heard a familiar voice (M=4.26) was lower than the cognitive load reported by students who heard an unfamiliar voice (M=5.26) and the difference between the groups was significant (MD=-1.00, P<0.01). Since everything else besides the narrator's voice was kept constant, this means that the unfamiliar voice group experienced higher extraneous cognitive load. In examining performance of the tasks by the two groups of students, it may be seen that the group that heard a familiar voice performed the recall test better (M=81.03) than the group that heard an unfamiliar voice (M=77.30) and the difference between the groups was found to be significant (MD=3.73, P<0.05). In examining the transfer task as well, it may be seen that the group that heard a familiar voice performed the task better (M=78.40) than the group that heard an unfamiliar voice (73.01) and the difference between the groups was found to be significant (MD=5.39, P<0.01). This shows that the learning process, as manifested in both the recall and transfer tasks, was more efficient among students who were exposed to a familiar voice than among students who were exposed to an unfamiliar voice, since the former invested a lower mental effort and their performance was higher.

LPE index compares different learning conditions and provides an indication as to the case in which the extraneous load was lower (Paas, Renkl and Sweller, 2003; van Gog and Paas, 2008). Based on the results obtained in the research, the extraneous load would appear to be lower with a familiar voice, or in other words, in the case of an unfamiliar voice, the students would apparently be busy with additional extraneous processes, inhibiting learning (Sweller, 2010).

Hypothesis 1.2 asserted that the efficiency of task performance (TE) of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice. The following equation was used to calculate TE (see Equation 3-1):

$$\mathbf{TE} = \frac{\boldsymbol{ZTaskPerformance - ZTaskMentalEffort}}{\sqrt{2}}$$

Factual conclusions

In testing **hypothesis 1.2,** the type of voice was found to have a significant influence on TE. However, in ***Tests of Between-Subjects Effects***, the type of voice was found to have a significant influence on the efficiency of task performance (TE) in recall task. However, in testing the efficiency of transfer task performance, the influence was found to be only marginal.

According to the means in Table 5-6, it may be seen that the marginal mean of TE-Rec among students who heard a familiar voice (M=0.241) was significantly higher than that of students who heard an unfamiliar voice (M=-0.162).

From Figure 5-3 it may be seen, that the efficiency index (TE-Rec) of the group that was exposed to a familiar voice (E_F) is located in the zone defined as high efficiency, whereas the efficiency index of the group that was exposed to an unfamiliar voice (E_U) is located in the zone defined as low efficiency.

According to the means in Table 5-6, it may be seen that the marginal mean of TE-Trn among students who heard a familiar voice (M=0.112) was higher than that among students who heard an unfamiliar voice (M=-0.080), i.e. the pattern of preference for a familiar voice was maintained, although the significance was limited (P=0.10).

From Figure 5-4 it may be seen, that the efficiency index of the group that was exposed to a familiar voice (E_F) is located in the zone defined as high efficiency, while the efficiency index of the group that was exposed to an unfamiliar voice (E_U) is located in the zone defined as low efficiency. However, as stated, the difference between the groups was only marginally significant.

Interpretations and conceptual conclusions

Hypothesis 1.2 was only partially confirmed, owing to the limited significance in the efficiency of transfer task performance. Since in the testing of Hypothesis 1.1 with respect to LPE, it was found that a familiarity with the narrator had an influence on the efficiency of the learning process – with a familiar voice having a more positive influence than an unfamiliar voice – a similar influence on the efficiency of task performance could have been expected as well, i.e. it could have been expected that the group whose learning process was more efficient would show less cognitive load during performance of the task and higher efficiency on task performance. Indeed, it may be seen from Table 5-4 that in performance of a recall task the load in the group hearing the familiar voice (M=4.65) was lower than the load in the group hearing the unfamiliar voice (M=5.36), with the difference between them being significant (MD=-0.71, P<0.01) and in performance of the task the group hearing the familiar voice obtained M=81.03 *versus* M=77.30 obtained by the group hearing the unfamiliar voice, with the difference between them also being significant (MD=3.73, P<0.05). However, the marginal finding in connection with the transfer task was somewhat in opposition to the research hypothesis and it is, therefore, worth subjecting this to a more in-depth examination in order to understand the reason for the difference between the efficiency of recall task performance and that of transfer task performance.

As may be seen from Table 5-4, the cognitive load in performing a transfer task in the case of the group hearing a familiar voice (M=6.07) was only slightly lower than the load of the group hearing an unfamiliar voice (M=6.18) and the difference between the loads was not significant (MD=-0.11, P>0.1), i.e. both groups invested nearly the same level of mental effort. On the other hand, the difference between the task performance of the groups was significant (MD=5.39, P<0.01), with the group hearing a familiar voice achieving an average grade (M=78.40) that was higher than that of the group hearing an unfamiliar voice (M=73.01). Thus, despite the marginal significance of the finding, the observed pattern was in line with the research hypothesis.

As stated before, during learning and in performance of a recall task, the cognitive load reported by the group hearing a familiar voice was lower than the one reported by the group hearing an unfamiliar voice and they were both lower than the loads they reported in the performance of the transfer task. However, in performance of a transfer task, the loads were not only higher in both groups, they were almost equal. This means that the gap between the load in transfer task *vis-à-vis* the other loads reported by them (in performance of a recall task and during learning) was greater for the group hearing a familiar voice than for the group hearing an unfamiliar voice. Comparing numbers, in the group hearing a familiar voice the load during performance of a transfer task was M=6.07 and the load during learning was M=4.26, i.e. a difference of (6.07-4.26)=1.81; the load during performance of a recall task was M=4.56, i.e. a difference of (6.07-4.56)=1.51. With the group hearing an unfamiliar voice, the load during performance of a transfer task was M=6.18 and the load during learning was M=5.26, i.e. a difference of (6.18-5.26)=0.92; the load during performance of a recall task was M=5.36, i.e. a difference of (6.18-5.36)=0.82. Thus, in the group hearing a familiar voice the load reported during the transfer task showed a higher increase relative to the mental effort invested during learning and during performance of a recall task than in the group hearing an unfamiliar voice. This was in contrast to expectations, since the learning process efficiency of the group hearing a familiar voice was higher, thus, making it reasonable to expect that they would invest less mental effort than the group hearing an unfamiliar voice. However, in order to optimise the conclusion in regards to the type of cognitive load involved in the task performance, performance score as a single variable should also be taken into consideration (Künsting, Wirth and Paas, 2011). The transfer task was higher than the recall task in element interactivity (detailed element interactivity of each of the tasks is presented in Appendices F, G and H) and apparently caused a higher intrinsic load in the two groups. However, since the students hearing a familiar voice learned more efficiently, as shown before by the LPE indices, they were more capable with dealing with the high element interactivity involved in performing the transfer task, thus, it seems they were allocating WM resources to generative process and hence the higher performance (Sweller, 2010; Sweller, Ayres and Kalyuga, 2011).

There is a close correlation between germane and intrinsic load, since performance of a task that causes intrinsic load to a reasonable degree, i.e. that which does not exceed the capacity of the WM, provides the basis for positive cognitive processes that cause germane load (Sweller, 2010; Kalyuga, 2011a; Sweller, Ayres and Kalyuga, 2011). Since the familiar voice group experienced a more efficient learning process, as found in relation to **hypothesis 1.1**, they were more capable in dealing with the transfer task's higher element interactivity, resulting in better performance. In other words, even though **hypothesis 1.2** in regards to transfer task (TE-Trn) was only marginally confirmed, it may be still inferred that the familiar voice had an advantage over the unfamiliar voice.

Hypothesis 1.3 asserted that the three-dimensional learning efficiency (3D-E) of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice.

The following equation was used to calculate the 3D-E (see Equation 3-3):

$$\mathbf{3D-E} = \frac{\boldsymbol{ZTaskPerformance - ZLearningMentalEffort - ZTaskMentalEffort}}{\sqrt{\mathbf{3}}}$$

Factual conclusions

It was found that there was a significant influence of type of voice on the three dimensional learning efficiency indices (3D-E). The influence of type of voice on 3D-E was found to be significant both in recall and in transfer tasks.

According to the findings shown in Table 5-6, it may be seen that the marginal mean of the three-dimensional efficiency index in recall task among students who heard a familiar voice (M=0.366) was significantly higher ($p<0.01$) than that of students who heard an unfamiliar voice (M=–0.261).

According to the findings in Table 5-6, it may be seen that the marginal mean of the three-dimensional learning efficiency grade in the transfer test among students who heard a familiar voice (M=0.261) was significantly higher ($p<0.01$) than that of students who heard an unfamiliar voice (M=-0.194).

From three-dimensional Figure 5-5 and Figure 5-6 it may be seen that both in recall and transfer tasks the efficiency of the group hearing a familiar voice (E_F) is located in the high efficiency octant whereas the efficiency of the group hearing an unfamiliar voice (E_U) is located in the low efficiency octant.

Interpretations and conceptual conclusions

As stated earlier, the 3D-E index presents a more comprehensive picture regarding learning efficiency, since it includes both mental effort reported by the students during the learning process and mental effort reported during performance of the task, whereas the other two indices consider only one load. The LPE equation takes into consideration the cognitive load during learning and the TE equation takes into account the cognitive load during performance of the task. According to Tuovinen and Paas (2004), this equation is supposed to 'iron out' fluctuations that could occur in the two other equations, which are 2-dimensional. In testing the three indices LPE, TE and 3D-E, it may be seen that they all point in the same direction, i.e. in all three indices, the group hearing a familiar voice showed a higher efficiency than the group hearing an unfamiliar voice. According to Tuovinen and Paas (ibid), taking into consideration the results of the two 2-dimensional equations and in addition, the results of the 3-dimensional equation gives a clearer picture of the difference between learning conditions. In addition, taking into account the explanations that were raised with respect to the possible reasons for the marginal significance in performing the transfer task, pointing at the possibility that the familiar voice group allocated more WM resources to generative processes, it may be claimed, that a significant influence exists in terms of the familiarity of the narrator's voice on performance of the task and on the efficiency of the learning process. For a comparison between the three learning efficiency indices in recall and transfer test see Figure 5-7 and Figure 5-8.

Hypothesis 2 asserted that the degree of motivation for performing a task (MT) in the case of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice.

The index MT was calculated according to the following equation (see Equation 3-4):

$$\mathbf{MT} = \frac{ZTaskMentalEffort + ZTaskPerformance}{\sqrt{2}}$$

Factual conclusions

The type of voice was found to have a significant influence on the motivation indices in performance of the task. However, in ***testing of between-subjects effects,*** a significant influence was found with respect to the type of voice on motivation in performance of the transfer task only and no significant influence was found with respect to the type of voice on motivation in performance of the recall task. Thus, **hypothesis 2** was confirmed only partially.

According to the findings in Table 5-7, it may be seen that the marginal mean of the MT index in performing the recall task among students who heard a familiar voice (M=-0.031) was lower than that of students who heard an unfamiliar voice (M=0.029). This finding was contrary to the hypothesis, but it should be emphasised that the difference was negligent (see also Figure 5-9). In performing a transfer task a significant influence was found with respect to the type of voice on motivation on task performance and the group that was exposed to a familiar voice showed a higher motivation than the group that was exposed to an unfamiliar voice, which is in accordance with the hypothesis.

According to the findings in Table 5-7, it may be seen that the marginal mean of MT-Trn among students who heard a familiar voice (M=0.117) was significantly higher than that of students who heard an unfamiliar voice (M=–0.074), see also figure 5-10.

Interpretations and conceptual conclusions

According to Paas, et al. (2005), who developed the MT computational equation and also according to (Kalyuga, 2011b), who examined researches that made use of it, the MT equation is still in its infancy and constitutes only an initial attempt at calculating the degree of involvement of students in performance of a task. In certain cases, it is still problematic and must be used with caution. Therefore, it is worth examining the components of the calculation on a case-by-case basis. An attempt will be made to figure out why the MT-Rec index was not significant while the MT-Trn was.

In examining the means of cognitive load and performance in the recall task, it may be seen from Table 5-4 that the cognitive load in the group hearing a familiar voice (M=4.65) was lower than the load in the group hearing an unfamiliar voice (M=5.36) and the difference between them was significant (MD=-0.71, $P<0.01$). In contrast, in performance of the task, the group hearing a familiar voice obtained a higher grade (M=81.03) than the grade obtained by the group hearing an unfamiliar voice (M=77.30) and the difference between them was significant (MD=3.73, $P<0.05$). In other words, it appears that the lack of significance between the groups in the index MT in performance of a recall task stems from the trade-off that occurs between low cognitive load and high performance in the case of a familiar voice and high cognitive load and low performance in the case of an unfamiliar voice. As claimed by Paas, et al. (2005), this must be taken into account when interpreting the findings. The optimal situation from the point of view of calculating the motivation for performance of the task was high mental effort with high performance, which attests to a willingness to invest and the benefit gained from such investment, something that did not happen here. The group hearing a familiar voice invested less effort and obtained a higher grade *vis-à-vis* the group hearing an unfamiliar voice, which invested greater effort but obtained a lower grade.

In contrast, with respect to performance of the transfer task, it is seen from the MT index, shown in Table 5-7, that the difference between the groups was significant. Motivation on the part of the group hearing a familiar voice rose (M=0.117) and is located in the high motivation quadrate (Figure 5-10) *vis-à-vis* the value they had in the recall task (M=-0.031), which is located in the low motivation quadrate (Figure 5-9). Motivation on the part of the group hearing an unfamiliar voice dropped (M=–0.074), which is located in the low motivation quadrate (Figure 5-10) *vis-à-vis* the value they obtained in the recall task (M=0.029), which is located in the high motivation quadrate (Figure 5-9). On examination of the loads, it may be seen that there was no significant difference between the loads in performance of the transfer task and that both the groups invested high mental effort. In contrast, performance of the transfer task of the group hearing a familiar voice (M=78.40) was better than performance of the transfer task by the group hearing an unfamiliar voice (M=73.01), see Table 5-4. It may be interpreted that the group hearing an unfamiliar voice found it too difficult, which can explain the drop in their motivation. Whereas the group hearing a familiar voice found it challenging and despite the difficulty, they succeeded in coping with the high intrinsic load exerted by the more difficult transfer task and performed the task on a higher level than the group hearing an unfamiliar voice.

In MT-Trn, there was a significant difference, stemming from the higher performance of the task among the group hearing a familiar voice. The description of motivation suggests that it corresponds to the amount of mental effort that a student is willing to invest in performing a task (Paas, et al., 2005). However, according to Paas, et al. (ibid), the equation contains an additional factor, since addition of the load and level of task performance results in motivation being dependent also on performance of the task; this is due to the fact that when the loads in two learning conditions are identical, it is better performance of the task that will cause a higher MT index. The research findings showed that this was exactly what happened with the MT-Trn index, since the levels of mental effort reported by both groups were almost identical.

In any event, the MT-Trn finding, which was higher with the group hearing a familiar voice, was consistent with ***Social Agency Theory*** and with the claim that states that when students are familiar with the narrator and have trust in him/her, interaction between them and the MM learning material is one of a partnership (Mayer, 2011a), i.e. a positive social interaction that provides the students with sufficient social cues to make them try harder to understand the material (Urdan and Maehr, 1995; Moreno, et al., 2001; Harrison and Atkinson, 2009).

According to Schnotz (2010), students who are more involved and motivated in performance of a task invest more WM resources in order to handle the intrinsic load and thus, improve learning. This can provide a good explanation for the better performance on the part of students from the group hearing a familiar voice.

Moreover, the significance of MT-Trn sheds additional light on the findings of **hypothesis 1.2** in connection with the index TE-Trn. Returning to the findings of **hypothesis 1.2,** we are reminded that it was confirmed only partially, since there was only a limited significant difference found between a familiar voice and an unfamiliar voice in TE-Trn. According to van Gog and Paas (2008), in the event where both the learning conditions are found to be equally efficient, or as in the case of TE-Trn, are nearly equally efficient because of the marginal significance, then the learning condition in which the student's motivation to invest in performing the task was higher was the more efficient one. In **hypothesis 2** it was found that motivation for performance of the transfer task (MT-Trn) when the voice was familiar was significantly higher than when the voice was unfamiliar and hence, it may be concluded that with respect to the efficiency of performing the transfer task (TE-Trn) as well, there was a preference for a familiar voice, despite the marginal significance.

Hypothesis 3 asserted that the assessment grade (NVSC-A) of the narrated video screen capture of students who heard a familiar voice will be higher than that of students who heard an unfamiliar voice.

Factual conclusions

The NVSC-A index reflects the perception of the students regarding the effectiveness of the learning material (Appendix L). The type of voice was found to have a significant influence on the NVSC assessment (NVSC-A) and according to the means in Table 5-8, it may be seen that the marginal mean of NVSC-A among students who heard a familiar voice (M=4.657) was significantly higher ($p<0.01$) than that of students who heard an unfamiliar voice (M=4.363), see also Figure 5-11. Thus, **hypothesis 3** was confirmed.

Interpretations and conceptual conclusions

Confirmation of Hypothesis 3 was in line with ***Social Agency Theory*** (Mayer, 2005b) and with the findings of research that found that students prefer a familiar voice in the case of audio recordings (Prion and Mitchell, 2007) and prefer the personal touch of the teacher via narrated PowerPoint presentations uploaded to the web (Mandernach, 2009).

The findings are in line with ***Social Agency Theory,*** since when exposed to a familiar voice the students probably experienced positive social interaction and perceived the teacher as a social partner who was concerned about explaining the material to them in the best possible way (Nass and Reeves, 1996; Mayer, 2005a; Geary, 2007), the assessment given for the NVSC was therefore, higher.

To conclude, a familiarity with the voice of the narrator in NVSC was found to have an influence in all the indices examined: efficiency of the learning process, efficiency of task performance, efficiency of the three-dimensional learning, motivation for performing the task and the feedback assessment on the NVSC, attesting to a perception of effectiveness in the learning material. These findings are compatible with ***Social Agency Theory*** (Mayer, 2005b), on which the research was based, as well as with CLT (Sweller, Ayres and Kalyuga, 2011), for it would be possible to attribute the findings on the difference in mental effort between the groups to the amount of social cues they received. The group that received more social cues were more successful in activating the schemas of positive social interaction and thus, were less preoccupied with extraneous processing in comparison with the other group. Thus, their learning was more efficient and so was their performance of the tasks. The index that was found to be marginally significant, TE-Trn and motivation for performance of the recall task, which was found not to be significant, were explained with interpretations pointing to an advantage to the familiar voice. Despite the fact that the above explanations are not lacking in interpretations with respect to the data and the relationship between them, it may be stated that the findings in this research allow it to be claimed fairly safely, within the limitations of the study, that, from the point of view of the students, where MM materials were concerned there was an advantage to narration with the voice of the teacher who was known to them and this advantage was not only a question of preference but was of objective significance with respect to the efficiency of learning and task performance.

6.1.2 Hypotheses regarding voice familiarity and gender similarity

The following hypotheses addressed the interaction between a familiarity with the narrator in NVSC and the *Gender Similarity Effect*.

Hypothesis 4 asserted that the learning and performance efficiency indices of students who heard an unfamiliar voice belonging to a gender identical to theirs will be higher than the learning and performance efficiency indices of students who heard an unfamiliar voice belonging to a different gender. It also asserted that there will be no influence of gender similarity when the voice of the narrator was familiar.

Hypothesis 4 was divided into three sub-hypotheses in accordance with the three efficiency indices:

Hypothesis 4.1 asserted that when the voice is unfamiliar the efficiency of the learning process (LPE) of students who heard a voice belonging to a gender that is identical to theirs will be higher than that of students who heard an unfamiliar voice belonging to a different gender; when the voice is familiar no difference will be found in the level of efficiency of the learning process (LPE) of students who heard a voice belonging to a gender identical to theirs *vis-à-vis* students who heard a voice belonging to a different gender.

Factual conclusions

It was found that there was significant interaction between the type of voice and the level of similarity; in ***Tests of Between-Subjects Effects*** and ***Bonferroni post hoc test for pairwise comparisons*** it was found that in LPE-Rec, as well as in LPE-Trn, a significant interaction exists. Thus, **hypothesis 4.1** was confirmed.

From Table 5-9, it may be seen that the LPE-Rec level of students who heard an unfamiliar voice belonging to a gender identical to theirs (M=0.044) was significantly higher ($p<0.01$) than that of students who heard an unfamiliar voice belonging to a different gender (M=–0.493). No significant difference ($p>0.05$) was found in the level of learning efficiency of students who heard a familiar voice belonging to a gender identical to theirs (M=0.260) *vis-à-vis* students who heard a familiar voice belonging to a different gender (M=0.345). Thus, apart from the fact that the group that heard a familiar voice was higher in LPE-Rec *vis-à-vis* the group that heard an unfamiliar voice, as found with respect to **hypothesis 1.1**, it is seen here that the group hearing an unfamiliar voice in NVSC with narration by a person belonging to a gender identical to theirs, showed higher learning process efficiency and indeed the gender similarity moderated the drop in efficiency when the voice was unfamiliar, see Figure 5-12

A similar influence can be seen in the case of the index LPE-Trn. The level of learning process efficiency as manifested in a transfer task on the part of students who heard an unfamiliar voice belonging to a gender identical to theirs (M=0.024) was significantly higher ($p<0.01$) than that of students who heard an unfamiliar voice belonging to a different gender (M=–0.493). No significant difference was found ($p>0.05$) in the level of learning efficiency on the part of students who heard a familiar voice belonging to an identical gender (M=0.287) *vis-à-vis* students who heard a familiar voice belonging to a different gender (M=0.333), see Figure 5-13.

Interpretations and conceptual conclusions

The above findings are consistent with ***Social Agency Theory*** and the *Similarity Attraction Principle*. According to the findings regarding the hypotheses on the influence of familiarity with the narrator's voice, students who heard a familiar voice showed more efficient learning; as found here, there was no *Gender Similarity Effect* when the voice was familiar, a fact that suggests that from the point of view of activation of the positive social schemas, there was a greater significance to the influence of familiarity with the narrator, so there was no additional significance to the *similarity effect of gender*. In contrast, when the students were exposed to an unfamiliar voice, when instinctively and unconsciously they sought channels in such a situation for social interaction with the narrator, the similarity between the gender of the narrator and theirs was the most available thing at their disposal when listening to the NVSC. Thus, students who were exposed to an unfamiliar voice belonging to a gender identical to theirs received more social cues, as a result of which their WM was less occupied with extraneous processes and their learning process was therefore more efficient *vis-à-vis* students who heard an unfamiliar voice belonging to a different gender.

Hypothesis 4.2 asserted that when the voice is unfamiliar the task performance efficiency (TE) of students who heard a voice belonging to a gender identical to theirs will be higher than that of students who heard a voice belonging to a different gender; when the voice is familiar, no difference will be found in the level of task performance efficiency (TE) of students who heard a voice belonging to a gender identical to theirs *vis-à-vis* students who heard a voice belonging to a different gender.

Factual conclusions

It was found that a significant interaction exists between the type of voice and the level of similarity. In ***Tests of Between-Subjects Effects*** and ***Bonferroni post hoc test for pairwise comparisons*** it was found that with respect to the performance efficiency of the recall test, the TE-Rec index, a significant interaction exists; however, in testing the interaction between the type of voice and the similarity level for efficiency of performance of the transfer task, TE-Trn, no significant interaction was found and this hypothesis was therefore confirmed only partially. See Table 5-9, Figure 5-14 and Figure 5-15.

Interpretations and conceptual conclusions

Confirmation of the hypothesis with respect to TE-Rec was in line with the *Similarity Attraction Principle* and ***Social Agency Theory*** and points to the fact that the combined influence of unfamiliar voice and different gender caused a stronger negative influence on the efficiency of performance of the recall task. This was because the students did not experience satisfying social interaction and did not receive social cues, either from a familiarity with the narrator or from a gender similarity. It seems that the similarity with the gender of the lecturer moderates the influence of a lack of social interaction see Figure 5-14.

According to **hypothesis 1.2** (index TE), which examined only the influence of familiarity with the narrator; it was found that there was a significant difference between a familiar voice and an unfamiliar voice in TE-Rec. It was also found in **hypothesis 4.2** that a similarity between the gender of the student and that of the narrator had a reinforcing influence. When the narrator was unfamiliar the TE-Rec index of the unfamiliar voice group was M=–0.162 (see Table 5-6), but on taking into consideration gender similarity as well, it is seen that in the group hearing an unfamiliar voice with an identical gender the index TE-Rec was M=0.098, whereas when the narrator's gender was different, TE-Rec was M=–0.422 (see Table 5-9). In other words, the lack of gender similarity had a strong influence on the efficiency of performance of the recall task when the voice was unfamiliar. With a familiar voice, gender similarity had a very minor and not significant influence.

As regards TE-Trn, it was found, in the testing of **hypothesis 1.2,** that there is only a limited significant difference between those who heard a familiar voice and those who heard an unfamiliar voice and testing **hypothesis 4.2** showed that gender similarity did not have a sufficiently strong influence to cause any change in the situation.

On conducting an in-depth examination of what happened with the group hearing an unfamiliar voice, from the viewpoint of the division between identical gender and different gender, as may be seen in Table 5-2 and Table 5-3 and on observing the mental effort during performance of the recall task, it is seen that the group hearing an unfamiliar voice belonging to an identical gender reported a lower mental effort (M=4.84) than the group hearing an unfamiliar voice belonging to a different gender (M=5.83). In the case of the transfer task, the group hearing an unfamiliar voice belonging to an identical gender reported a slightly higher mental effort (M=6.33) than the group hearing an unfamiliar voice belonging to a different gender (M=6.057), i.e. in the recall test there was a greater difference in the reported mental effort between the same-gender group and the different-gender group relative to the difference in the mental effort between these groups in the transfer task. In effect, in the transfer task, the difference in the mental effort between the same-gender group and the different-gender group was blurred, i.e. during performance of the transfer task, the same-gender group stepped up its mental effort *vis-à-vis* the effort that it invested in performance of the recall task, to a greater degree than was done by the different-gender group (see Table 5-2). On examining performance, exhibited by the task score, it may be seen that in the case of the recall task the same-gender group hearing an unfamiliar voice (M=79.287) performed better than the different-gender group hearing an unfamiliar voice (M=75.538); in the case of the Trn task too, the same-gender group hearing an unfamiliar voice (M=75.053) performed better than the different-gender group hearing an unfamiliar voice (M=71.198). It is, thus, seen that in the transfer task the two groups had enhanced loads, with the same-gender group not only experiencing a greater cognitive load relative to that they experienced in the recall task, but even reporting a greater load than that of the different-gender group, which is in contrast to the hypothesis. At the same time, the same-gender group performed the task better. Here too it is possible to offer explanations as were given for the index TE-Trn in **hypothesis 1.2**, except that in that case the discussion centred on the influence of familiarity with the narrator. Here too it is possible to interpret the findings as an example of germane processing deriving from the greater ability of the same-gender group due to their higher learning process efficiency. As stated earlier, there is a connection between intrinsic load and germane processing and one sees the same phenomenon here, as observed in connection with the influence of familiarity with the narrator, when in the stage of the more difficult task the group that received more social cues (the same-gender group) performed on a higher level, probably because they were more capable due to their more efficient learning process. In other words, despite the fact that the interaction in the TE-Trn index was not found to be significant, the pattern that emerges from the findings suggests an advantage to similarity of gender when the voice of the narrator is unfamiliar.

On the subject of the voice of a known narrator, the assumption was that there would be no interaction with gender similarity, since with a familiar voice the student receives sufficient social cues. As discussed under **hypothesis 1.2** with respect to TE-Trn, the mental effort in performance of a transfer task was considerable, both with the group hearing a familiar voice and with the group hearing an unfamiliar voice, apparently due to the difficulty of the task, i.e. high element interactivity, such that gender similarity did not succeed in changing the situation. It should be noted that the influence of gender similarity, like voice familiarity, is an influence that is carried over from the learning stage, for this was the stage in which the students experienced interaction with the NVSC and those who experienced a more efficient learning process were more capable dealing with the task. It will also be recalled that in connection with the index LPE significant interaction between narrator's familiarity and gender similarity was found with respect to both performance of a recall task (LPE-Rec) and performance of a transfer task (LPE-Trn). On the other hand, in measuring the efficiency of task performance in the case of a recall task (TE-Rec), which was the easier task, the advantage gained by the students who heard an unfamiliar voice belonging to the same gender during the learning stage finds expression during the stage of recall task performance (Künsting, Wirth and Paas, 2011) ; they studied more efficiently and therefore the efficiency of recall task performance (TE-Rec) was higher with them relative to those who heard an unfamiliar voice belonging to a different gender. However, when they reached the transfer task performance stage, an additional factor was introduced, namely, the difficulty of the task. Here, interaction between the student and the task was apparently more significant (Paas and van Merriënboer, 1994a). It appears that relative to those who heard a familiar voice, the transfer task was difficult for all who heard an unfamiliar voice and the advantage of the same gender, manifested in the index LPE, which was representative of the learning process, did not find expression here, to the extent that no significant difference existed between those who heard an unfamiliar voice belonging to the same gender and those who heard an unfamiliar voice belonging to a different gender. It should be noted that the main effect of gender similarity was weak (Appendix V) and in most of the cases marginal; therefore, the moment a significant factor, such as difficulty of task, was introduced the difference between the groups disappeared.

Hypothesis 4.3 asserted that when the voice is unfamiliar, the three-dimensional learning efficiency (3D-E) of students who heard a voice belonging to a gender identical to theirs will be higher than that of students who heard a voice belonging to a different gender; when the voice is familiar no difference will be found in the 3D-E efficiency of students who heard a voice belonging to a gender identical to theirs *vis-à-vis* students who heard a voice belonging to a different gender.

Factual conclusions

It was found that with respect to the index 3D-E a significant interaction exists between the level of familiarity with the narrator's voice and gender similarity.

In the ***Tests of Between-Subjects Effects***, a significant interaction was found to exist between narrator familiarity and gender similarity in the index 3D-E in performance of a recall task. The index 3D-E-Rec of students who heard an unfamiliar voice belonging to the same gender ($M=0.106$) was significantly higher ($p<0.01$) relative to students who heard an unfamiliar voice belonging to a different gender ($M=-0.627$), see Table 5-9. No significant difference was found ($p>0.05$) in the index 3D-E-Rec of students who heard a familiar voice belonging to the same gender (M=0.325), relative to students who heard a familiar voice belonging to a different gender (M=0.407). No significant interaction was found between narrator familiarity and gender similarity in examining learning efficiency 3D-E in performance of the transfer task – index 3D-E-Trn. Thus, the hypothesis was confirmed only partially see, also, Figure 5-16 and Figure 5-17.

Interpretations and conceptual conclusions

It will be recalled that the three-dimensional index incorporates the indices of learning efficiency and task performance efficiency and therefore provides a more comprehensive picture (Tuovinen and Paas, 2004). In the case of interaction between a familiarity with the narrator's voice and gender similarity, in the case of the different-gender group the decrease in the index 3D-E-Rec, going from the familiar voice (M=0.407) to the unfamiliar voice (M=–0.627) was steeper relative to the case of the same gender group, whose efficiency decreased from M=0.325 when the voice was familiar to M=0.106 when the voice was unfamiliar, see Figure 5-16.

At the stage of transfer task performance, load for all increased, perhaps due to the high intrinsic load imposed by the task and the differences became blurred, so that the index 3D-E-Trn does not show significant interaction with gender similarity.

To conclude, with respect to the efficiency indices, it may be stated that a situation in which the voice was both unfamiliar and belongs to a different gender was the worst from the point of view of the learning process efficiency. When the voice was familiar, a similarity between the gender of the narrator and that of the student was of no consequence, which is in line with the research hypothesis; thus, it may be stated that familiarity with the narrator is more important and once the voice is familiar to the student it makes no difference if the teacher is of the same gender or not. However, when the voice is unfamiliar, gender similarity allows the student positive social interaction, thus, assisting in learning.

Hypothesis 5 asserted that when the voice is unfamiliar, the degree of motivation for task performance (MT) of students who heard a voice belonging to an identical gender will be higher than that of students who heard a voice belonging to a different gender; when the voice is familiar no difference will be found in the degree of motivation for task performance (MT) with students who heard a voice belonging to an identical gender *vis-à-vis* students who heard a voice belonging to a different gender.

Factual conclusions

It was found that a significant interaction exists between the familiarity with the narrator and gender similarity, although in ***Tests of Between-Subjects Effects*** and in ***Bonferroni post hoc test for pairwise comparisons*** for testing the interaction between type of voice and level of gender similarity with respect to motivation in performing the recall task, index MT-Rec, a marginal significant interaction was found (P=0.073); in the testing of interaction between the voice and the level of gender similarity with respect to motivation in performing the transfer task MT-Trn, no significant interaction was found. See Table 5-10, Figure 5-18 and figure 5-19.

Interpretations and conceptual conclusions

On examining the cognitive load and performance data (Table 5-2) with respect to the group hearing an unfamiliar voice in a recall task, it appears that when the gender was identical, the load was M=4.84 and when the gender was different the load was M=5.83; the performance level in the case of identical gender was M=79.287 and the performance level in the case of a different gender was M=75.538. There was, thus, a trade-off here between low load and high performance in the same gender group and high load and low performance in the different gender group and it is possible that this was the reason for the limited significance (Paas, et al., 2005).

In performing the recall task, contrary to the hypothesis, it was precisely with an unfamiliar voice belonging to a different gender that higher motivation than the rest of the groups was found (see Table 5-10). From a glance at Table 5-2 it may be seen that this group reported higher cognitive load (M=5.83) and reached a lower performance level (M=75.538). In other words, according to the rationale underlying the motivation equation, the investment of high mental effort attests to a willingness for involvement in performance of the task and it appears here that the group hearing an unfamiliar voice belonging to a different gender invested a higher mental effort in performing the task than the group hearing an unfamiliar voice belonging to the same gender. With reference to the similarity effect, it may be stated that something has been reversed here and that there are in fact signs of the *Opposite Attraction Effect* (Graves and Powell, 1995; Jones, et al., 1998). This finding joins those of the many researchers that have addressed the *similarity effect*, which found mixed, non-significant and even contradictory findings (Graves and Powell, 1988; Crosby, Evans and Cowles, 1990; Gallois, Callan and Palmer, 1993; Churchill, Ford and Walker, 1997; Dwyer, Orlando and Shepherd, 1998; Smith, 1998; Hardin, Reding and Stocks, 2002; Lee, Liao and Ryu, 2007; Behrend and Thompson, 2011), this being an additional proof of the fact that it is not a particularly stable or strong effect. In any event, of all the indices which were tested in relation to the interaction of gender similarity with voice familiarity, this phenomenon, which suggested the *Opposite Attraction Effect*, was manifested only in the index MT-Rec, while it should be borne in mind that only a limited significance was found there.

As stated, no significant difference was found between the same gender and different gender groups with unfamiliar voice in the transfer task. In Table 5-3 it may be seen that the same gender group experienced higher cognitive load (M=6.33) than the different gender group (M=6.057), which implies that they were more involved and more willing to invest in performing the task and at the same time their performance was higher (M=75.053) than the different gender group (M=71.198). However, their performance was not high enough to yield a significant difference in the MT-Trn index.

Hypothesis 6 asserted that when the voice is unfamiliar, the feedback assessment of the video screen capture, NVSC-A, of students who heard a voice belonging to an identical gender will be higher than that of students who heard a voice belonging to a different gender; when the voice is familiar no difference will be found in the feedback assessment of the video screen capture of students who heard a voice belonging to an identical gender *vis-à-vis* students who heard a voice belonging to a different gender.

Factual conclusions

In testing the interaction between the level of familiarity with the narrator and gender similarity level in the feedback assessment NVSC-A, no significant interaction was found (see Table 5-11 and Figure 5-20). In other words, **hypothesis 6** was not confirmed.

Interpretations and conceptual conclusions

The results were in contradiction to the *Similarity Attraction Principle (*Nass and Yen, 2010) and not as expected. According to this principle, students who heard an unfamiliar voice should have received more social cues from the voice of a narrator belonging to the same gender as theirs and feel a higher level of social interaction, so that their assessment under these conditions could be expected to be higher. However, it turned out that no interaction existed here. It should be reminded that in regards to **hypothesis 3**, which deals with the influence of familiarity with the narrator's voice only, it was found that a familiarity with the narrator's voice had an influence on the NVSC assessment: when the NVSC was heard with narration by a narrator who is known, a higher assessment was obtained and as explained, this was consistent with ***Social Agency Theory***. In the case of an unfamiliar voice, the expectation was that the experience of positive social interaction would derive from gender similarity, but this did not happen, in contradiction to the *similarity effect*. *Gender similarity* also did not have a main effect on the assessment. This finding, which contradicted the *gender similarity effect*, was in line with the findings of researches that were conducted in different fields, which did not find a *gender similarity effect* (Hardin, Reding and Stocks, 2002; Lee, Liao and Ryu, 2007; Girard and Pinar, 2009; Behrend and Thompson, 2011), as well as the findings of Graves and Powell (1995) and Jones, et al. (1998), who even found an *Opposite Attraction Effect*. From a review of the various research studies that were conducted on the subject of the *gender similarity effect* (see section 3.6.1), it is seen that inconsistent findings were obtained. In this research as well, its influence was found to be significant in some of the indices and not significant in others, while in the index MT-Rec even the reverse phenomenon was found. In any event, the *gender similarity effect* was found here to be weaker than the influence of familiarity with the narrator. It is seen here that from the point of view of the students' perception, the *similarity effect* has no influence, as manifested in the index NVSC-A in the assessment questionnaires that the students completed immediately after viewing the NVSC.

The interesting thing here nonetheless, was that in spite of the fact that students' perception of the NVSC did not show an advantage to the same gender unfamiliar narrator, an interaction was found, under **hypothesis 4.1** in the efficiency of the learning process (LPE) both in the recall test and in the transfer test. These findings could suggest that, the *similarity effect* perhaps did, nevertheless, influence learning. However, when students were asked to rank the NVSC in relation to their perception of the quality of the learning material and the quality of learning by means of the NVSC, it was seen that when the voice was unfamiliar there was no difference between students who heard a voice belonging to the same gender and students who heard a voice belonging to a different gender, being contradictory to **hypothesis 6**. However, if we look at the learning process efficiency (LPE), see Table 5-9, it is seen that there was an influence and with an unfamiliar voice learning process efficiency was higher when there was a gender similarity both in recall and transfer tasks, i.e. despite the fact that from the point of view of their perception, according to which there was no significance to gender similarity when the voice was unfamiliar, it turns out that in actual fact, an influence did exist. It will be recalled that in testing **hypothesis 3** in relation to NVSCs assessment (NVSC-A), when the influence of familiarity with the narrator was examined, there was compatibility between the students' perception regarding the effectiveness of the recording and their learning process efficiency, see Table 5-6 and Table 5-8. In other words, the students themselves felt that it was better for them to learn when narration was with the voice of a known narrator rather than with an unfamiliar voice, but when the voice was unfamiliar, there was no longer any perceived distinction between similar and different gender, even though in practice an influence did exist.

6.1.3 Hypotheses regarding conscientiousness and voice familiarity

Interaction between the trait of **conscientiousness** and familiarity with the narrator was examined for the indices of efficiency and motivation.

Hypothesis 7 asserted that the influence of **conscientiousness** on the learning efficiency and motivation indices will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

Hypothesis 7 was divided into three sub-hypotheses in accordance with the three efficiency indices. In connection with the testing of **hypothesis 7.1,** which asserted that the influence of **conscientiousness** on the level of learning efficiency (LPE) will be greater among students who heard an unfamiliar voice *vis-à-vis* a student who heard a familiar voice. The factual conclusions for all the **conscientiousness** related hypotheses will be presented first and then interpretations and conclusions will be introduced.

Factual conclusions

In examining the interaction between **conscientiousness** and type of voice (familiar/unfamiliar) no significant interaction was found and therefore **hypothesis 7.1** was not confirmed. It should be noted that neither was a main effect found of **conscientiousness** on the index LPE.

Hypothesis 7.2 asserted that the influence of **conscientiousness** on task performance efficiency (TE) would be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

Factual conclusions

In testing the interaction between **conscientiousness** and type of voice (familiar/unfamiliar), no significant interaction was found. Therefore, **hypothesis 7.2** was not confirmed. Neither was a main effect found of **conscientiousness** on the index TE.

Hypothesis 7.3 asserted that the influence of **conscientiousness** on the level of three dimensional learning efficiency (3D-E) will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

Factual conclusions

In testing the interaction between **conscientiousness** and type of voice (familiar/unfamiliar), no significant interaction was found. Therefore, **hypothesis 7.3** was not confirmed. Neither was a main effect found of **conscientiousness** on the index 3D-E.

Hypothesis 7.4 asserted that the influence of **conscientiousness** on the level of motivation for task performance (MT) will be greater among students who heard unfamiliar voice *vis-à-vis* students who heard a familiar voice.

Factual conclusions

In testing the interaction between **conscientiousness** and type of voice (familiar/unfamiliar), no significant interaction was found. Therefore, **hypothesis 7.4** was not confirmed. However, a significant main effect was found of **conscientiousness** on the indices MT-Rec and MT-Trn, but with both indices the regression coefficients were non-linear that is, we cannot state the direction of that correlation.

Interpretations and conceptual conclusions

The main effect finding was not consistent with the findings of Komarraju and Karau (2005), who claimed that personality traits are strongly related to academic motivation – explaining the firm link between **conscientiousness** and academic success (more conscientious students would be more motivated and would therefore perform better academically). It was also not in line with other research, which found that learners with high **conscientiousness** show greater motivation, an ability to overcome difficulties and a willingness to invest in performing tasks (Costa and McCrae, 1985; Furnham and Medhurst, 1995; Diseth, 2003; Eilam, Zeidner and Aharon, 2009). However, as regards the research hypotheses, it was apparent that despite the fact that a familiarity with the narrator's voice influences mental effort and performance of the task on the part of the learner, no interaction was found between **conscientiousness** and familiarity with the narrator in any of the indices tested. In all the research studies that investigated **conscientiousness** in the context of academic studies, academic achievement was examined, with the index in this connection being GPA (Grade Point Average) and motivation (Wagerman and Funder, 2007; Zyphur, et al., 2008; Schnuck and Handal, 2011). No research was found that examined the connection between **conscientiousness** and learning efficiency. This research found no connection between **conscientiousness** and learning efficiency and therefore no interaction was found with a familiarity with the narrator's voice either. In the context of the research, the expectation was that in a situation where there is a certain difficulty in the learning conditions, such as the voice of an unknown narrator, the trait of **conscientiousness** would come into play and students that are more conscientious would perform on a higher level than students who are less so. A possible explanation for the fact that even a main effect of **conscientiousness** on the indices of learning efficiency was not found could be that in all the studies that did find a connection between **conscientiousness** and academic achievement, achievement was examined over time (GPA). The present research examined performance that was measured in the framework of a one-time experiment and it is possible that if research was conducted that investigated the connection between **conscientiousness** and learning efficiency over time, a different result would be obtained. The conclusion of the research in this respect was that despite the fact that a familiarity with the narrator's voice was found to influence the learning efficiency indices and an unfamiliar voice was found to hinder learning, the trait of **conscientiousness** does not find expression here.

6.1.4 Hypotheses regarding test-anxiety and voice familiarity

Hypothesis 8 asserted that the influence of **test-anxiety** on the learning and performance efficiency indices will be greater among students who heard an unfamiliar voice *vis-à-vis* students who heard a familiar voice.

The hypothesis was divided into three sub-hypotheses in accordance with the three efficiency indices

Hypothesis 8.1 asserted that the influence of **test-anxiety** on the level of efficiency of the learning process (LPE) will be greater among students who heard an unfamiliar voice *vis-à-vis* students who heard a familiar voice. The factual conclusions for all the **test-anxiety** related hypotheses will be presented first and then interpretations and conclusions will be introduced.

Factual conclusions

In testing the interaction between **test-anxiety** and type of voice (familiar/unfamiliar), no significant interaction was found and thus, **hypothesis 8.1** was not confirmed. However, a significant main effect was found of **test-anxiety** on the level of efficiency on the learning process, LPE: the higher the **test-anxiety**, the more the efficiency of the learning process drops both in recall and transfer tests.

Hypothesis 8.2 asserted that the influence of **test-anxiety** on the level of task performance efficiency (TE) will be higher among students who heard an unfamiliar voice *vis-à-vis* students who heard a familiar voice.

Factual conclusions

In testing the interaction between **test-anxiety** and type of voice (familiar/unfamiliar), no significant interaction was found. Thus, **hypothesis 8.2** was not confirmed. A significant main effect of **test-anxiety** was found on the level of efficiency in task performing (TE); the higher the level of **test-anxiety**, the more the efficiency of task performance drops both in recall and transfer tests.

Hypothesis 8.3 asserted that the influence of **test-anxiety** on the level of three dimensional learning efficiency (3D-E) will be greater among students who heard an unfamiliar voice *vis-à-vis* students who heard a familiar voice.

Factual conclusions

In testing the interaction between **test-anxiety** and type of voice (familiar/unfamiliar), no significant interaction was found. Thus, **hypothesis 8.3** was not confirmed. However, a significant main effect of **test-anxiety** was found on the level of three-dimensional learning efficiency, 3D-E: the higher the level of **test-anxiety**, the more the three-dimensional learning efficiency drops, both in recall and transfer tests.

Hypothesis 8.4 asserted that the influence of **test-anxiety** on the motivation for task performance (MT) will be greater among students who heard an unfamiliar voice *vis-à-vis* students who heard a familiar voice.

Factual conclusions

In testing the interaction between **test-anxiety** and type of voice (familiar/unfamiliar), no significant interaction was found. Thus, **hypothesis 8.4** was not confirmed and no main effect of **test-anxiety** was found on the index of motivation.

In other words, it was found that no interaction exists between type of voice and **test-anxiety** for the indices of efficiency and motivation.

Interpretations and conceptual conclusions

The findings were not consistent with the statement that **test-anxiety** is an affective trait (Pintrich, et al., 1991; Eunsook, 1998). Numerous researchers have found that **test-anxiety** is a trait that is manifested particularly in a high level of non-relevant cognitive load (Eysenck, et al, 1985; Naveh-Benjamin, 1991; Schwarzer and Jerusalem, 1992; Kane and Engle, 2000; Ashcraft and Kirk, 2001; Beilock and Carr, 2005). According to the assumptions of the research, which were based on CLT and ***Social Agency Theory***, cognitive load was expected to rise with students having high **test-anxiety** because of the additional difficulty in exposure to NVSC with narration by an unfamiliar teacher. Hearing an unfamiliar voice has been assumed to raise non-relevant thoughts and hence extraneous cognitive load with students and accordingly, their performance level would be expected to drop; as a consequence the indices of efficiency and motivation would supposedly be affected correspondingly. However, it was evident that although **test-anxiety** had a main effect on the efficiency indices, exposure to an unfamiliar voice did not make it any worse.

To conclude, the examination of the hypotheses on individual differences in **conscientiousness** and **test-anxiety** between students showed that a familiarity with the narrator did not interact with those traits. The individual differences influenced the efficiency indices in some of the indices measured in the research in the form of a main effect but did not add any difference beyond that which existed between the groups that heard a familiar voice and an unfamiliar voice.

The following figure (Figure 6-1), visualises the findings of the research in terms of the influence of voice familiarity and gender similarity on learning efficiency:

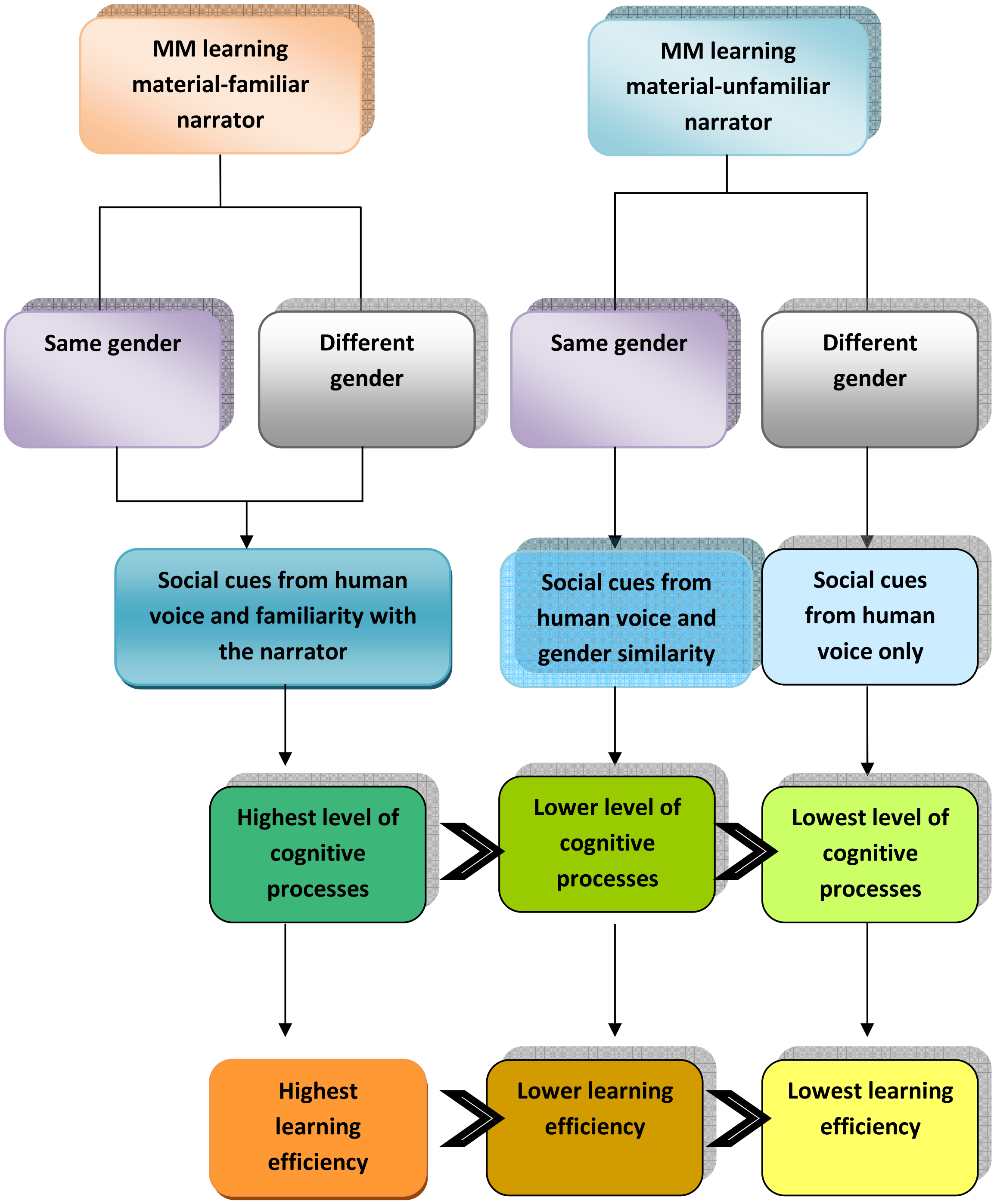

Figure 6-1: The influence of familiarity with the narrator and the interaction with gender similarity

Figure 6-1 shows the influence of familiarity with the narrator on the students' learning efficiency. On the right end is the MM learning material with an unfamiliar narrator. The flow chart splits between unfamiliar narrator of the same gender as the student's and an unfamiliar narrator of the opposite gender. It can be seen that with an unfamiliar narrator of the same gender the student receives social cues from two sources namely, the human voice and gender similarity while with an unfamiliar narrator of the opposite gender the student receives social cues from the human voice only, which results in lower level of social activation and thus, lower learning efficiency than with the unfamiliar voice of the same gender. On the left end of Figure 6-1 one can see the box of the MM learning material with a familiar voice. It can be seen that gender similarity has no influence in terms of additional social cues and in both cases the student receives social cues from the human voice and the familiarity with the narrator only. However, this kind of social activation leads to the highest cognitive processes and hence highest learning efficiency. Social cues from a human voice are common to all three learning conditions and the only difference comes from the additional sources of social cues the student receives. It can be inferred from Figure 6-1, that the student receives more social cues from familiarity with the narrator and when the narrator in unfamiliar social cues are elicited from narrator-student gender similarity.

6.2 Discussion related to the corroborative qualitative data

The semi-structured interviews were held after the preliminary analysis of the data collected during the experiments and they were intended to add clarification to the quantitative data. Findings of the semi-structured interviews can be found in Table 5-13.

The present research did not focus on the technical aspects of the NVSCs, thus, attention will be given to the rest of the categories. Checking students' statements in Table 5-13 reveals that the majority of the students related to the cognitive aspects of the NVSC. Table 5-13 shows that students find many advantages to learning through a NVSC, but still they do not think that this learning method is a good substitute for a face-to-face learning. That is, NVSC is perceived as a useful auxiliary learning material. 16 out of 37 (43%) students who were interviewed prefer a familiar voice and 20 (54%) students have no preference for a specific voice (one student (2%) expressed a preference for a variation of voices). Although, only 37 students were interviewed and only 16 out of them said that they preferred a familiar voice, it was enough to indicate, that familiarity with the narrator is an issue that deserves attention and further investigation. Thus, the statements derived from the interviews set the basis for the close- ended follow-up questionnaire that was handed to all the participants for further corroborative data.

6.3 Discussion related to the corroborative quantitative data

The follow-up questionnaire (Appendix O) was presented to the students a few weeks after the experiments and aimed to obtain data regarding students' preference in relation to the familiarity with the narrator in the NVSC. In the follow-up questionnaire, the students were introduced for the first time to the real aim of the research.

Question no. 1 in the follow-up questionnaire aimed at getting students' preference in relation to the familiarity with the narrator. Table 5-14 for question no. 1, shows that 56.16% stated that a familiar voice is important to them, while 43.83% stated that it makes no difference to them. This finding was in line with ***Social Agency Theory*** (Moreno, et al., 2001) and other studies that found preference for a familiar narrator (Prion and Mitchell, 2007; Salmon and Nie, 2008; Mandernach, 2009). The question was posed to the students after they had been exposed to the NVSC and it is important to emphasise this, since the answers were not of a hypothetical nature but were based on the actual experience of listening to a familiar or unfamiliar voice. Since question no. 1 touches on the essence of the research, it was further tested against the efficiency indices in order to see if there was a connection between the students' preference and the efficiency and motivation indices. It should be remembered that there were no hypotheses relating to the connection between students' preferences and learning outcomes. The semi-structured interviews and the follow-up questionnaire which was based on them, served as additional input from the students, in order to find out if familiarity with the narrator was an issue at all and since it was found that it was something that attention should be paid to, the follow-up questionnaire was conducted in order to get quantitative corroborative information and a deeper understanding regarding students' preferences.

Question no. 2 in the follow-up questionnaire aimed at getting students perceptions of an unfamiliar narrator. The findings of question no. 2 show (see Table 5-15) that the vast majority of the statements selected by the students attribute a negative influence to an unfamiliar voice and of those who do not relate negatively to an unfamiliar voice there is a higher percentage of those who are more indifferent than those who attribute positive characteristics to an unfamiliar voice. This is consistent with ***Social Agency Theory*** (Mayer, 2005b), which claims that students react more positively when they receive social cues. This finding is also in line with the findings of Prion and Mitchell (2007), who found preference for the voice of a familiar lecturer in audio recordings.

Question no. 3 referred to experience with a familiar voice. As can be seen in Table 5-16, the overwhelming majority of the selected statements attributed positive characteristics to a familiar voice and a negligible percentage attributed negative or neutral characteristics to it. Again, this is consistent with ***Social Agency Theory*** and the findings of Prion Mitchell (2007).

In the findings of question no. 3, as opposed to question no. 2, it is seen that when a question is explicitly asked regarding a familiar voice, the tendency is to attribute a positive influence to it and this is practically across-the-board relative to question no. 2, where the students were asked about an unfamiliar voice, i.e. questions no. 2 and no.3 were almost the same, only phrased in an inverse mode. Although the majority attributed a negative influence to an unfamiliar voice, there were still some who stated that it made no difference to them, while there were even a few who attributed a positive influence to an unfamiliar voice. A possible explanation for the difference between the answers to questions no. 2 and no. 3 in relation to the percentage of students attributing positive or negative statements to the familiar and unfamiliar voice is that when attention is directed to a familiar voice, the students have a mental representation of the person behind the familiar voice. The response is therefore more focused and stems from a sense of actual interaction that had taken place with a familiar person. In contrast, when asked about an unfamiliar voice, there is no mental representation, the concept is more amorphous and the answers are therefore more speculative.

6.3.1 The relation between students' preference of voice and the indices of efficiency and motivation

In order to test the relation between students' preference and their learning efficiency indices, the students' data were divided into four groups and an independent T-Test was conducted in order to compare the groups' means. The four groups were:

- Preference for a familiar voice and heard a familiar voice.
- No preference and heard a familiar voice.
- Preference for a familiar voice and heard an unfamiliar voice.
- No preference and heard an unfamiliar voice.

Table 5-17 shows that in the groups of students who stated that they have no preference, there was a significant difference in cognitive load during learning between those who heard a familiar voice (M=4.04) and those who heard an unfamiliar voice (M=5.16) MD=-1.14, p<0.01. This means that even though no difference would be expected between exposure to a familiar voice and to an unfamiliar voice in the case of students who stated that they have no preference, it was found that they too were affected by exposure to an unfamiliar voice. The comparison between the means show higher cognitive load in the unfamiliar group *vis-à-vis* the group of students that stated that they have no preference but heard a familiar voice. In examining the cognitive load during performance of a recall task within the no-preference group, a significant difference was found between those who heard a familiar voice (M=4.74) and those who heard an unfamiliar voice (M=5.32) MD=–0.58, p<0.1. However, on examining the cognitive load during performance of the transfer task and in examining the performance of both recall and transfer task, no significant difference was found between the familiar and unfamiliar group of the no preference students.

Table 5-18 shows that there was a difference in cognitive load during learning and during performance of the recall task between a familiar voice and an unfamiliar voice, both with the familiarity preference group and those of no preference. In the transfer task, the load in both groups was lower with a familiar voice. However, here there was no significant difference between a familiar voice and an unfamiliar voice. In all four cases the load during performance of the transfer task was high and this takes us back to the explanations given earlier on the subject of high cognitive load in the transfer task: it appears that the impact of task difficulty comes into the picture here as well, adding to the load of both the familiarity preference and no preference groups. Among the familiarity preference group, the performance was higher when they heard a familiar voice *vis-à-vis* those who heard an unfamiliar voice and the difference was found to be significant in both the recall task and the transfer task. However, among the no preference group, although performance was higher in the familiar group than in the unfamiliar group both in recall and transfer tasks, the difference was not significant, as might be expected.

In examining the efficiency indices namely, LPE, TE and 3D-E (Table 5-18), it may be seen that with all the indices, the no preference group worked with higher efficiency than the familiarity preference group and their efficiency indices were higher both with a familiar voice and with an unfamiliar voice. However, students who had no preference and listened to a familiar voice exhibited significantly higher learning process efficiency (LPE) than students who had no preference and listened to an unfamiliar voice, which shows that even students who felt that they did not have any particular preference still were affected when listening to an unfamiliar voice. See Figure 5-21 and Figure 5-22 for the LPE findings, Figure 5-23 and Figure 5-24 for the TE findings, Figure 5-25 and Figure 5-26 for the 3D-E findings and Figure 5-27 and Figure 5-28 for the MT findings.

These corroboration findings of the follow-up questionnaire reinforce the quantitative findings, collected in the first phase of the research and indeed show, that a familiar voice plays a role in students' learning, even when the students are not aware of the influence that this has on their learning. However, since the data for question no. 1 of the follow-up questionnaire were collected after the experiments and were not part of the research hypotheses, only a T-test was performed (see Tables 5-17 and 5-18), which allows only simple comparison of means. A further investigation should be conducted in order to figure out the exact causes for these differences and whether there is an interaction between voice familiarity and students' preference. Perhaps, those who had no preference, which means, they feel at ease with an unfamiliar narrator, as well as with a familiar narrator, were students with greater self-confidence or better cognitive capabilities, thus, they were more capable in task performance.

To summarise, the findings of the research showed that in a blended learning environment incorporating MM learning materials, the degree of familiarity with the narrator has an influence and that there is an advantage to narration with the voice of a teacher who is known to the students *vis-à-vis* an unfamiliar voice and when the students are exposed to an unfamiliar voice there is a partial advantage to student-narrator gender similarity. There was no interaction between familiarity with the narrator and students' differences exhibited by **conscientiousness** or **test-anxiety**.

Practically speaking, from the perspective of instructional design and HCI, it may be said that in the case of the MM learning materials, the best learning situation for the students is narration with the voice of the teacher who is known to them and the worst situation is narration with a voice that is unfamiliar to them and belongs to the opposite gender. Thus, in cases where narration in the voice of the teacher who is familiar to them is not possible, as may happen when using LOs from OER repositories, it is preferable that narration be in a voice belonging to the same gender as that of the students.

6.4 Conclusion

Multimedia research is still in its infancy (Mayer, 2005a) and this study adds to the growing body of research, related to the instructional design of MM learning material. The present research stemmed from the ***Social Agency Theory*** (Mayer, 2005b), CTML (Mayer, 2005a) and CATLM (Moreno, 2005; Moreno and Mayer, 2007) and was conducted in a blended learning environment from the perspective of cognitive load. Use was made of NVSCs in the research, which presented MM example modelling as aids for reviewing and catching up for missed lessons, a learning method that has been found in previous studies to be suited to the field of ***Computer Literacy*** owing to the procedural learning that it requires. The NVSCs met the criteria of the CTML (Mayer, 2005a) and were presented to the students with narration by known and unknown teachers. The research found that when the students have a personal relationship with the class teacher, exposure to MM learning materials with narration in the voice of a teacher who is not known to them has an adverse influence on the efficiency of the learning process by means of these materials and on the efficiency of subsequent task performance, relative to exposure to MM learning materials with narration by a teacher known to them (see section 6.1.1).

Regarding perception of the effectiveness of the learning materials, the students, who were not aware of the aim of the research, expressed their preference for NVSC with narration by a teacher known to them in the assessment questionnaire (NVSC-A) and ranked the recordings with an unfamiliar voice lower, even though the recordings were similar in all other respects (see section 6.1.1).

The research also examined the *Similarity Attraction Effect* from the point of view of gender similarity as a factor that could provide additional social cues in the interaction with the NVSC. The research checked to see if interaction exists between the *Gender Similarity* and the degree of familiarity with the narrator. Examination of the *Gender Similarity Effect* showed that this had an influence, especially on the efficiency of the learning process, although this influence was weaker than that of familiarity with the narrator's voice. When the narrator was known, gender similarity between the narrator and the student had no influence; however, when the narrator was not known, the influence of gender similarity came into play in some of the indices (see section 6.1.2). It should be emphasised, that no claims can be made in terms of gender, since it was not used as a variable here. The only variable related to gender used here was gender similarity between the student and the narrator.

The semi-structured interviews supported the assumption that familiarity with the narrator should be an issue to be investigated in regards to MM learning and set the basis for the follow-up questionnaire, for further insight into the impact of familiarity with the narrator (see section 6.2).

Comparing students' preference and their learning efficiency indices, it was found that even when the students declared that they have no preference for a particular voice, their learning efficiency indices were, nevertheless, higher with a familiar voice (see section 6.3). Although, it should be noted that the causality relationship between preferences and voice familiarity was not within the scope of the research and it may be left for future research.

No interaction was found between individual differences in **conscientiousness** and **test-anxiety** and the degree of familiarity with the narrator's voice in NVSC (see sections 6.1.3 and 6.1.4).

6.5 Implications

From the practical point of view, the research topic is interesting because of the growing use of repositories of LOs as aids in blended learning, with many of them being of the MM kind. In the light of the latest researches in the field of instructional design, which indicate that aside from the didactic aspects and content of the learning materials, attention should also be paid to the affective aspect (Moreno, 2007; Moreno, 2009; Moreno, 2010; Kalyuga, 2011b), it is important for the teachers to know if they can freely refer their students to MM aids from the repositories of LOs, as good as they may be, with narration by other teachers. From the practical point of view, it is also important to know if a group of educators can cooperate and together develop such reusable learning materials for use by all students. The vexing question is whether in blended learning, the use of MM learning materials with narration by a strange teacher is less effective for the students, in terms of learning efficiency *vis-à-vis* exposure to MM learning materials with narration by a teacher who is known to them. According to the conclusions of the research, it appears that if lecturers are interested in RLOs that are best for their students, it is preferable that they be with their own voice and if the voice of the narrator is not one that is known to the students, then it is preferable that it belong to a person of the same gender as the student.

6.6 Research Limitations

The present research attempted, as far as possible, to address the problems that arose in other studies conducted from the perspective of cognitive load, by use of a natural learning environment and by avoiding the artificiality inherent in laboratory conditions.

Although research studies that are carried in a realistic situation rather than in a laboratory setting may show a more accurate picture of students' cognitive load and performance and although utilising quasi-experimental designs minimises threats to external validity as natural environments do not suffer the same problems of artificiality as compared to a well-controlled laboratory setting, thus, allowing for some generalisations to be made, they set other problems (Shadish, Cook and Campbell, 2002). Students participating in the research were convenient sampling (Burns and Grove, 2005). Thus, imposing limitations on the external and internal validity of the study and a limitation in generalisation (see section 4.7).

The fact that the researcher was also the course teacher, for part of the participants, raised ethical, as well as bias concerns. Ethical concerns were taken care of, as described in the ethical aspects section 4.12. Bias was avoided, as much as possible, by letting an external examiner, unaware of the research focus, rate students' performance according to a very detailed rubric (see section 4.9.2).

Since most of the data in this study were quantitative, collected via questionnaires and test files examined by an impartial examiner, the problem of lack of objectivity was somewhat mitigated. The main concern should have been the semi-structured interviews phase, where a bias could have caused the researcher to ask directed questions and give subjective interpretations to what the students said. Thus, maximum care was also taken in the collection of qualitative data: all the interviews were recorded and transcribed by impartial professional transcribers. Moreover, the qualitative data did not serve for testing the research hypotheses or for the derivation of conclusions. The statements that were extracted from the interviews were given to all the students who participated in the research as a follow-up questionnaire, so that in the final analysis objective quantitative data were gathered once again. It should be noted that the corroborative quantitative data collected in the second part of the research (the follow-up questionnaire) could be more suspect, in terms of having an informant bias, because at this stage the students were already aware of the research focus, since a declaration of it appeared at the head of the questionnaire. The questionnaire also included a direct question as to the students' preferences and here it is possible that they would try to please the researcher. On the other hand, the students at this stage were no longer in a power relationship with the researcher, since the semester was over.

Regarding the researcher’s bias, it is important to note that this research did not include an examination of the researcher’s method of instruction. The investigation dwelt only on the perspective of a familiarity with the narrator's voice, with one of the voices being that of the researcher. In other words, there was no issue of the researcher’s teaching or other capability being put to the test, in which case the interpretation could be biased. Thus, it may be stated that the researcher’s approach to the subject of the research was fairly neutral. At the same time, if one, legitimately, considers the possible existence of a bias, whether to a greater or lesser degree, it should be borne in mind, that it could be two-sided: the knowledge that the students wish to hear the researcher’s voice could perhaps be complimentary but on the other hand, a preference for a familiar voice could place the researcher in a somewhat serious dilemma. This would mean that every couple of years on the upgrade of the software it would be necessary to remake all the video tutorials anew, because by seeking learning materials featuring other narrators, found freely in LOs repositories, the researcher would be giving the students less than the best. Thus, it is difficult to say what the researcher really wanted to hear.

Although the research did not deal with life stories or intimate experiences on the part of the informants, it is still possible that the researcher’s capacity as the course lecturer, students would be apprehensive about revealing the whole truth, based on the concern that the researcher would then judge them or be offended. On the other hand, precisely because the researcher was the lecturer and the person preparing the learning materials, it is possible that the students were more motivated to share their experience on the NVSC with her.

The research is a case study and therefore, there is a limitation with respect to its generalisability. It was conducted in the framework of a ***Computer Literacy*** course in a particular college among adult students. Use was made of learning materials of a specific type, namely, NVSC. It is possible that with a different type of MM learning materials a different picture would be obtained. It is possible that in different contexts and different populations the influence of various narrators in MM learning materials would change. Therefore, in all matters relating to learning efficiency it would be worth examining this on a case-by-case basis. Regarding the generalisability issue, it should also be noted that effect sizes (Partial η^2 scores) were low to moderate. The fact that there was no large effect size found for either the influence of voice familiarity or the interaction between voice familiarity and gender similarity should call for a further study in order to consolidate the results. It should be noted here, that previous studies in regards to the various *voice effects*, namely the personalisation effect (Clark and Mayer, 2011), the effect of foreign accented voice and human *versus* computerised voiced (Mayer, Sobko and Mautone, 2003), reported large effect sizes. However, these studies were conducted in artificial laboratory conditions. As suggested by criticisers of the laboratory experiments, recent studies try to replicate the same effects in natural learning environment. As one example, a study regarding the politeness effect (Nass and Reeves, 1996; Nass and Brave, 2005), when run in a classroom situation yielded lower effect size than when run in an artificial laboratory conditions (McLaren, DeLeeuw and Mayer, 2011). An explanation to the differentiation between laboratory situation and natural learning environment may be that in the natural learning situation students are more motivated to perform well, thus, they overcome learning conditions that are expected to exert difficulty on their learning. Moreover, in the present study, the tasks were part of the course activities and gained students credit points for the final grade, which means that students were motivated to do well for the proper reason and not in order to please the researcher. Students were also allowed note-taking, NVSCs pace could be controlled by the students and learning time was not restricted as much as in laboratory experiments. These facilitating conditions, which naturally help students, especially when encountering a less favourable learning situation, like MM learning with unfamiliar narrator as in this study, may explain the low to medium effect sizes shown here, but it should be remembered that the natural learning environment is the one which is of most interest for educators, so it makes more sense to study various learning conditions in a natural learning environment be it virtual, traditional or blended rather than in an artificial laboratory setting.

The mental effort questionnaire, of which use was made in the research (Paas, 1992; Paas, et al., 2003), involves subjective reporting and is only one of many different measuring tools which are more objective and are also intended to measure cognitive load. In the current research, this questionnaire was chosen because it is less intrusive and thus, suited the research environment chosen, namely, a natural learning environment. As a measuring tool, it is convenient, non-intrusive and highly trustworthy. It is possible that other measuring tools such as stimulated recall interview (Beers, et al., 2008; van Gog, et al., 2009) or dual task measures (van Gog, et al., 2009) would give a different picture.

The recall and transfer questions, of which use was made here were performance tasks, which were graded according to a detailed rubric (Appendices P, Q and R). Even though a statistical test was conducted for consistency, which was found to be very high, it is still possible that there is an erroneous ranking of students' performance here and that it would have been better to replicate the research with the students' performance being measured with the help of multiple choice questions, where ranking is not open to interpretations and is therefore more accurate.

6.7 Contribution to knowledge

On the theoretical level, the findings of the research showed that there is significance to a familiarity on the part of students with the narrator in NVSCs, when personal bonds are formed with the course lecturer in class. CTML (Mayer, 2005a) has contributed greatly to knowledge related to instructional design of MM learning materials while also, among other things, focusing attention on the influence of the narrator's voice on learning (see section 3.5). In all previous studies, the research environment was that of an artificial laboratory, exposing the participants to learning material dealing with a subject area irrelevant to them, as a result of which, they were the target of criticism by researchers in the field (de Jong, 2010). This research took note of these criticisms, as a result of which, it was conducted in the natural environment of the students, using a topic of study that was relevant to them and allowing natural learning conditions to the extent possible, including the freedom to take notes and permitting time for revision of sections that were not understood. The uniqueness of the research lay in the fact that it was carried out in a blended learning environment with conditions different to those in previous researches: the students had personal contact with the course lecturer. Such a situation introduced an affective factor, deriving from the personal bonds formed with the course teacher, which were found to influence learning by the students. The conclusions derived from the findings that emerged from this research offer an addition to theoretical knowledge on ***Social Agency Theory*** (Mayer, 2005b), CTML (Mayer, 2005a) and CATLM (Moreno, 2005)**,** which suggested taking into consideration affective issues as well. It should be noted that although a significant influence was found of familiarity with the narrator, this research cannot say anything about the factors that caused the influence, besides relying on the assumptions made, based on ***Social Agency Theory,*** that social cues elicited by the familiar narrator, reduced students' extraneous cognitive load and thus, resulted in higher learning efficiency.

On the practical level, recent years have seen the increasingly widespread use of repositories containing LOs – digital learning materials for extensive and repeated use by educators worldwide. Thanks to technological advancements and the development of popular software intended for use by non-professionals in the field of technology, the development of MM LOs has also expanded. The uniqueness of these materials, as against exclusively textual or visual learning materials – which can be neutral from the point of view of the connection between them and the person producing them – lies in the fact, that they bear the personal stamp of the educators who developed them. This includes their voice, which, as found in earlier studies, can enable the transfer of messages to the listeners that go beyond their literal content (Nass and Brave, 2005).

According to the research findings, in a situation where the students have already formed a personal bond with the course lecturer, it becomes apparent that a familiarity with the narrator in MM learning material, in addition to the student's preferences, also has an influence on the efficiency of learning. In the light of these findings, educators who choose learning materials from repositories should use their discretion by seeing beyond the quality of the content and the accuracy of the materials. They must also take into account the target student population (adult, non-traditional students or traditional ones) and the context in which they incorporate materials of this type. In a teacher centred blended learning situation, where an appreciable part of the study takes the form of frontal sessions – a factor that supposedly develops personal contact with the lecturers – is it fitting to refer students to learning materials of other lecturers. Educators in such a situation must carry out a cost-benefit analysis and arrive at the conclusion as to whether they wish to invest time, as well as possibly other resources in development of their own personal learning materials, or else, choose to refer students to learning materials of other lecturers, in the knowledge that they are less efficient for them. It is important to emphasise that the research findings do not suggest that learning materials prepared by other lecturers are not effective for students, or worse, that they sabotage learning efficiency, assuming, naturally, that they are indeed suitable from any other aspect of instructional design, e.g. content, accuracy and relevance to the subject matter. What the research findings suggest is that all other attributes remaining the same, MM learning materials with narration by a teacher who is known to the students from the classroom will be perceived by them as more effective and, in fact, will be more effective in practice, allowing a more efficient learning. Thus, the study added to practical knowledge in offering practical implications for educators who wish to incorporate digital materials to enrich their courses.

On the educational policy level, if indeed MM learning materials with narration by a known teacher contribute more to the efficiency of learning in a blended learning environment, as found in this research, it is fitting that the authorities responsible for HE allocate resources that will enable educators to develop their own personal learning materials. This can take the form of offers for professional development to those who are interested in investing time in creating their own materials. Equally important is the auxiliary technological and pedagogic staff to assist the educators in developing learning materials, taking on the tasks of general handling, technical editing and even development of content, with the teacher's contribution being restricted to narration only. If the educational system were to provide educators with the necessary content, texts, software and technical assistance, leaving the educators responsible only for the recording of their narration and its subsequent integration into the suitable video passages, the relief afforded educators would encourage many to develop their own MM learning materials. An additional possibility is to reward educators for developing their own personal learning materials.

A technological innovation worth considering is an authoring tool that would allow educators to reuse an existing narrated video tutorial with a feature enabling them to record a sample of their voice with all its nuances – pitch, intonation, etc. – whereupon the program itself would change the audio to sound like the teacher's voice. This way the efficiency of the learning materials would be enhanced while the teacher would save precious time. In conclusion, the current study contributes to knowledge, suggesting there is an influence of familiarity with the narrator, by offering ideas to policy makers within HE regarding the possibility of investing resources to enhance the effectiveness of MM learning materials incorporated in courses.

6.8 Future research

The present research identified a narrator's familiarity influence in MM learning but this conclusion needs additional consolidation due to the research limitations referred to in section 6.6. In addition, it is worth examining the influence of familiarity with the narrator's voice over time, since it is possible that after a number of attempts the listener will get accustomed to an unfamiliar voice (Levi and Pisoni, 2005), in which case the influence would disappear. In this research, the examination was conducted with novice students; it is possible that if it had been carried out with more knowledgeable, the results would have been different.

Given that there is a significance to social cues in the interaction between the learner and the MM learning materials (Nass, et al., 1995; Nass and Reeves, 1996; Moreno, et al., 2001; Atkinson, Mayer and Merrill, 2005; Mayer, 2005a) and given that in the present research a significance was found from this point of view to the student's familiarity with the narrator, practically speaking, it is not always possible for educators to produce learning materials with their own narration and it would, therefore, be desirable to seek other means to enhance social cues and a sense of positive social interaction with these materials. Previous research pointed to the *Politeness Effect* (Wang, et al., 2008; McLaren, DeLeeuw and Mayer, 2011) and the *Personalisation Effect* (Mayer, 2005a; Mayer, 2011a) as contributors of social cues via narration. Perhaps it would be possible to find an instructional design that would compensate for exposure to an unfamiliar voice in a blended learning environment.

No measurement was conducted in this research of the degree of social interaction felt by the students in the various groups. Social interaction was assumed, based on ***Social Agency Theory*** (Mayer, 2005b). It would have been worthwhile to add questionnaires and interviews that would examine more clearly the students' perception regarding the social interaction that was created between them and the learning material with the different voices. Thus, it would be possible to identify which social cues are missing with an unfamiliar narrator and try to design MM learning material that can compensate for it.

This research was conducted from a cognitive load perspective. However, it might be assumed that a familiar narrator increases students' trust in the learning material hence their confidence in their ability to perform the subsequent tasks. Since it was found that self-efficacy is positively correlated with academic achievement (Pintrich and Schrauben, 1992b; Bandura, 1993; 1997), it is interesting to find out whether this is the factor that makes learning with a familiar narrator a more favourable learning condition. Moreover, since it is assumed, according to the ***Media Equation Theory*** (Nass and Reeves, 1996), that students are in a state of interaction with the computer during learning with MM materials and based on ***Social Agency Theory*** (Mayer, 2005b), serious thought should be given to the implications of this interaction from the affective point of view.

Instructional design that will enhance the learner's motivation is critical to raise the efficiency of learning, for without motivation no learning can take place. Moreover, the computations for examining the efficiency of learning are also based on the assumption that the learners are motivated and are doing their best to learn and perform the task. In the light of the criticism that has been levelled against the research of cognitive load (de Jong, 2010; Moreno, 2010) and in the light of the understanding that affective factors must also be taken into consideration (Moreno, 2010; Kalyuga, 2011b), attention should be focused on the conditions that will stimulate motivation for study and the proper means must be found to measure this. Use was made in the research of an equation for measuring motivation, as proposed by Paas, et al. (2005). As of now, this equation is considered a preliminary, isolated attempt at measuring the student's involvement in performing the task under certain learning conditions (Paas, et al., 2005; Kalyuga, 2011b), as opposed to the degree of motivation as a trait, or as directed to a particular course of study (Pintrich, et al., 1991). Cautionary warnings were expressed regarding the equation's drawbacks at the time it was proposed (Paas, et al., 2005); indeed, in the present research too, the picture obtained with its help did not always appear to be clear and the findings needed numerous interpretations. Moreover, the indices obtained using this calculation (MT-Rec and MT-Trn), were the only ones that caused a violation of the homogeneity assumption (see Table

5-5). It is therefore recommended, to verify the findings of this equation with other measurements of motivation that focus on instructional motivation, such as for example, the Questionnaire on Current Motivation) QCM) (Rheinberg, Vollmeyer and Burns, 2001; Rheinberg, 2006). Although, as pointed out by Schnotz, Fries and Horz (2009), there is a certain amount of overlapping between this questionnaire and the means for measuring cognitive load proposed by Paas, et al. (2003), which was used for the computation of motivation on task (MT) in the present study.

The present research measured the mental effort invested by the students during learning and task performance, as well as actual performance of tasks, in order to calculate the degree of motivation invested during task performance. Alternatively, it would have been possible to measure their persistence, i.e. how long they were willing to invest in performance of the task, this too being an index that could attest to motivation (Vollmeyer and Rheinberg, 2000; Schnotz, Fries and Horz, 2009).

The influence of familiarity with the narrator was examined in a case study in the context of procedural knowledge; however, in order for generalisations to be derived from the findings it is desirable to repeat it also in connection with other types of knowledge like conceptual or strategic knowledge (Schnotz and Kürschner, 2007).

On the subject of the *similarity effect*, most of the research that investigated this effect examined it from the point of view of preference or attitude with respect to the narrator (Harrison and Atkinson, 2009). In the present research, an attempt was made to examine whether the *similarity effect* would also influence the efficiency of learning. It would be worth examining this in additional research studies.

Finally, no interaction was found in the present research between a familiarity with the narrator's voice and individual differences with respect to **conscientiousness** and **test-anxiety**. Since the affective aspect of MM learning is gaining ground, especially from the perspective of cognitive load, it would be worth checking to see if other personal traits exist that might interact with the *voice familiarity effect*.

6.9 Epilogue - My journey as a researcher

In retrospect, my learning, during my doctoral journey, influenced my life from personal, professional and academic points of view.

On the personal level, conducting the research taught me several things about myself. Persuading my participants to collaborate with me in providing data for my research taught me a lesson in human relations. Managing the abundance of data at my disposal taught me a lesson in organisation and management. Analysing my data in relation to my research goals taught me lessons on prioritising my activities and managing my time.

On the professional level, the doctoral journey afforded me an abundance of knowledge about research methodology and about conducting research that would be rigorous and systematic enough to be easily justifiable and then strengthen the confidence in my findings. The result was that I learned how to conduct good reliable research.

Additionally, from conducting the research, I learned not to accept the professional reality as is, but to analyse my surrounding as a researcher and gain insights from this analysis. Conducting the research afforded me with learning tools for life. Finally, as I presented my research findings, my academic discourse changed from that of a field expert into that of a researcher.

In addition, I discovered a new world of generous, high level cooperation between people from all parts of the world who did not know each other. When I came upon the learning efficiency formulas (Paas and van Merriënboer, 1993), which were not clear to me in the beginning, I had no one to ask. I decided to send Prof. Paas a personal email. The polite, detailed reply I received, within a few hours, included a comprehensive explanation, as well as additional articles for reading. When the critique of Prof. de Jong (de Jong, 2010) on CLT was published, I sent an email to Prof. Sweller and simply asked him if he had an answer to that criticism. Within a short time I received an article (Sweller, 2010), which was still in the final stages of writing, even before its publication in a journal. There were many other researchers whom I approached personally with specific questions or requests for articles that I could not obtain, such as Prof. Schnotz (Schnotz and Kürschner, 2007) and Prof. Donaldson (Donaldson, Flannery and Ross-Gordon, 1993) and I always received positive replies that had clearly been sent with alacrity. Naturally, I am grateful to them all. All this was new and surprising to me. I cannot say that I did not have difficult moments, when for days on end I did not see the light of day and did not take my hands off the keyboard. Nevertheless, the thought of giving up did not occur to me. I was drawn into the research and the more I invested in it the more my interest grew.

The interviews with the students were captivating. Already in the exploratory research stage, I had been deeply impressed with their willingness to devote time to me and tell me about their experience with the course website. Later, they were ready to share with me their feelings during the learning sessions with the NVSCs. I felt they genuinely wished to help even though I was no longer their lecturer. This contributed to the good feeling I had – that even though this journey was mine and that I was learning on my own and wrestling with myself only, there was also a togetherness and a willingness to cooperate.

What amazed me more than anything else was the fact that even though the process took seven years and was fraught with difficulties and deliberations, I did not for a minute think of throwing in the towel. To my utter surprise, as I neared the finishing line, I felt that I did not want it to end. I might say that in the framework of this journey, I learned more about myself as an independent learner and researcher than I did new theories and now, as I see it, the end of this thesis is only the beginning of new studies in the future.

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Appendices

Appendix XA- Exploratory research-

Students' assessment of the learning material on the course website

(Time spent on site with each type of the learning materials (frequencies

	Time	text	%	Abbreviated	%	screens	%	videos	%
2006	1-2 min	4	7%	4	7%	17	26%	16	27%
	3-10 min	32	52%	20	34%	33	50%	25	42%
	11-30 min	16	26%	21	36%	12	18%	11	18%
	31-60 min	8	13%	10	17%	3	5%	7	12%
	over an hour	1	2%	3	5%	1	2%	1	2%
	Total	61		58		66		60	
	Missing	14		17		9		15	
	total	75		75		75		75	
2007	1-2 min	15	14%	17	16%	22	22%	13	12%
	3-10 min	46	44%	40	37%	42	43%	31	28%
	11-30 min	26	25%	33	31%	27	28%	33	30%
	31-60 min	12	12%	13	12%	6	6%	21	19%
	over an hour	5	5%	4	4%	1	1%	12	11%
	Total	104		107		98		110	
	Missing	14		11		20		8	
	total	118		118		118		118	

Perceived usefulness of the learning materials- average on a 6-point scale

	Detailed text Mean(SD)	Abbreviated commands Mean(SD)	Print screens Mean(SD)	videos Mean(SD)	Total Mean(SD)	F (DF)
2006	3.18(1.22)	3.20(1.4)	3.13(1.26)	3.07(1.58)	3.14(1.36)	0.122(3)
2007	3.77(1.24)	2.89(1.19)	3.27(1.54)	4.94(0.76)	3.6(1.43)	37.800(3)***

p<0.01 ***

Preferences for learning materials (frequencies)	**2006**	**%**	**2007**	**%**
I watch mainly texts	27	41%	15	13%
I watch mainly commands briefs	13	20%	13	11%
I watch mainly print screens	11	17%	19	16%
I watch mainly videos	15	23%	71	60%
Total	66		118	
missing	9			
total	75		118	

Appendix XB- Exploratory research -

Use of various learning material on the course web site- academic years- 2006-2007

		Students enrolled	Students accessed course web site	No. of accesses to text materials	Average access to text materials	No. of accesses to commands briefs	Average access to commands briefs	No. of accesses to static print screens	Average access to static print screens	No. of accesses to NVSCs	Average access to NVSCs
Academic year-2006	Group1	43	34	306	4.0	34	5.7	163	1.4	289	1.0
	Group2	45	45	977	12.7	61	10.2	412	3.4	3054	10.6
	Group3	60	60	1027	13.3	26	4.3	508	4.2	3426	11.9
	Group4	55	51	749	9.7	31	5.2	221	1.8	1886	6.6
	Group5	60	49	1140	14.8	82	13.7	594	5.0	2592	9.0
Total		263	239	4199	10.9	234	7.82	1898	3.16	11247	7.82
Academic year 2007	Group6	42	24	60	0.8	13	2.2	113	0.9	3505	12.2
	Group7	49	47	59	0.8	11	1.8	107	0.9	4106	14.3
	Group8	77	72	57	0.7	12	2.0	110	0.9	5963	20.8
	Group9	54	51	59	0.8	14	2.3	125	1.0	9581	33.4
	Group10	48	47	59	0.8	12	2.0	120	1.0	7052	24.6
Total		270	241	294	0.78	62	2.06	575	0.94	30207	21.06

Each course web site contained the same learning material items which were:

- 287 items of NVSCs;
- 77 documents of textual materials;
- 120 documents containing static print screens;
- 6 documents with abbreviated commands;

Appendix XC- Exploratory research-An in-depth interview with a student

Researcher: Thank you for answering my invitation and coming. I will explain the purpose of this meeting. Apart from the fact that I have my own website, I am also responsible in the college for the course sites. And I see that not all the lecturers use the sites so I wanted to find out what the benefit of these sites is to the students, whether they add to learning and make it worthwhile for the lecturer to invest efforts in them.

Student: Websites have a very great benefit in my opinion. Personally, I am always using the site.

Researcher: Really?

Student: All the time. For example, all the presentations that are uploaded to the site, they are the best there is.

Researcher: You mean presentations in other courses?

Student: Also. In your course for example, the thing that helped me the most was the recorded lectures.

Researcher: The NVSCs?

Student: Yes, I worked only according to this because the written material, especially what you took from Microsoft Help, was slightly less clear.

Researcher: Yes, I took material from Microsoft Help. And I also took sections from textbooks on computers.

Student: Right.

Researcher: They were also not clear?

Student: It's possible that if I had delved deeper, it would have been clearer. From my point of view the video was the easiest to take in and the clearest, you understand, I also saw how actions are performed and saw live how things happen and I also heard your voice, so for me personally, it helped a lot.

Researcher: I have a question. Did it make a difference that it was my voice or could it have been anything, instruction by anyone?

Student: It's possible that psychologically it would have made a difference because since you are used to hearing the voice of the lecturer in the classroom, the minute you hear his voice on video, it's something that helps you understand.

Researcher: Could it also be that I use the same words as you heard in the classroom?

Student: It's the same intonation, the same voice and the same words so it makes things easy, everything is familiar, it's easier to associate it with the lesson itself. For me personally it is the only way I studied. I missed a few lessons and it was only this way that I learned. I sat, listened to all the lectures. The minute I encountered a problem in the homework I would listen to the recorded lecture. Just so.

Researcher: Really?

Student: It really, really helped me.

Researcher: But in these recordings, it was not like the lecture. For in the lesson I start off with an introduction, I explain why each thing is necessary and what its purpose is. In the NVSCs it was very focused, how to perform the various commands and nothing more.

Student: True.

Researcher: Didn't this bother you? Wasn't a background explanation missing?

Student: Perhaps if you were not in the lesson at all you would in fact need a background. For example, if I encounter a problem and you solve a similar problem then the very fact that you solved it helped me to understand my mistake. For example, there was the Excel COUNTIF formula, for me personally it really helped and my friend from a different course as well. I let him study; I gave him the password and told him to study this way because it's the only way. And he too said that it was really great.

Researcher: Really?

Student: Yes, I told him at the outset, go straight to the video and forget about the other materials because the materials with the textual explanations are less clear.

Researcher: Was it not clear from the point of view of content or do you not like text?

Student: It was not clear; there was something unclear in it. I don't know, perhaps it's because it's a different method of instruction.

Researcher: Yes, it's written text.

Student: No, but it's also the wording of the text. Perhaps because I relate it to the things that are said in the classroom or perhaps if the text was written in your words it would be easier to understand. Perhaps it's because of this that I did not delve deeper into it.

Researcher: Do you remember at the start of the semester, when we learned Word, there was a document on the website with summarised commands. Every command was explained in several steps and with a minimum of text, in the style of ‘how to’. Was it good?

Student: This was also good.

Researcher: Because it is in summary form without too many words?

Student: When you are doing an assignment, for example, like in a computer course, then at times it's good that it is brief. Because all in all it's trial and error, you do something, you make a mistake and you see your mistake according to the recording or according to the commands summary. There is no need to study and read so much text. I personally think that if everything was recorded, all the material, it would be great and sufficient. If only we had such recordings in statistics.

Researcher: Recordings for what?

Student: For instance, for home exercises.

Researcher: But in statistics you work with programs?

Student: We don't work with programs. But if the lecturer were to make a recorded lecture like in your website, it could also help in the homework. The tutorial, for example, could also help.

Researcher: I have a question. There is a course in the college in which the entire lecture is recorded with a video camera. In other words a lecture of an hour and a half is a recording of an hour and a half.

Student: Okay.

Researcher: And the whole hour and a half is uploaded to the site. Is that good?

Student: Yes.

Researcher: And if my lecture were recorded in such a manner, that is, someone would sit and photograph an hour and a half and an hour and a half would be uploaded for each lesson.

Student: Yes. I know a lot of people who study this way. In one of the universities for example, all the physics lessons are recorded and then you study at home. People sit at home with a recorded lecture and this helps them a lot.

Researcher: And do the students always listen to a recorded lecture of their lecturer or is it a recording from the previous year?

Student: No, it's their lecturer from the same lesson.

Researcher: Does it make sense to you that every year in every course the course would be filmed anew? Things change and even lecturers change.

Student: True. Some of the lectures were from previous years.

Researcher: The thing is that it is not possible every year to record the same courses again. So what can happen is that they will decide this year to make a recording and in the next year's course they will be running the recordings of the previous year. Is there a problem with this?

Student: Why should there be a problem with this?

Researcher: Because it's not always exactly the same material.

Student: Generally speaking it's the same.

Researcher: The material is in general similar but look, I know from my own experience that I do not always manage to cover exactly the same material that I taught in the previous semester with a different group, even in the same semester with a different group. It's enough that I have one student who asks a question that takes 10 minutes to explain so that I end up with something I don't manage to cover.

Student: Of course.

Researcher: The question is; is there a problem with this, that there isn't 100% correspondence?

Student: Look, we are after all not in the Open University, we are after all required to attend lessons. It's not that we are free not to attend lessons. All in all it's additional auxiliary material; it's not intended to replace learning in the lesson. But it's very effective for exams. It's very effective that you have something where, if you missed a lesson and if there are things that the lecturer spoke about last year and did not say this year in the classroom, nothing terrible's happened. There are questions that a student asked and the following year the group did not ask. You know, these are things that in the final analysis if you read both the written material of students in the class and take a recorded lecture – these are things that help. It can only benefit, not harm.

Researcher: Did you access the site during the course of the semester or only before the exam?

Student: Your site specifically? It's only when I had to give in an assignment that I accessed the site.

Researcher: You accessed the site only for the exercises?

Student: Yes, it's only that way that I understood the exercises.

Researcher: Was it not enough what I explained in the class?

Student: I was not present in all the lessons.

Researcher: In this context, that you were not present in all the lessons, did the fact that you knew there were learning aids on the website enable you to decide more easily not to attend the lessons?

Student: No. I didn't attend for other reasons. I had work obligations. I'm sorry.

Researcher: You don't have to apologise. I know. You saw that I was not particular about taking attendance.

Student: I sat at home towards the end of the semester with the recorded lectures and this helped me a lot. I was only sorry that I had not sat down to it earlier, I would have made an effort in the recorded lectures and I would have received a much better grade. I came to a handful of lessons and all the rest I learned at home. But this was not due to the knowledge that it existed. I just couldn't make it. And the materials on the website simply made it easier. Because if you phone friends each time you miss a lesson, the minute you call someone to explain to you how to do the exercise, he can give you an explanation on the phone but it won't have the same effect as the lecture. At times I would listen to the same video a number of times and it would sink into my head and then I would find it much easier for the exam.

Researcher: And did you try to see the NVSC and at the same time open the Excel, for example and work together with the NVSC?

Student: That's impossible.

Researcher: Impossible? Why?

Student: I don't know. It's not possible. It didn't work together.

Researcher: And if it did work together, would that have been good?

Student: I prefer it otherwise, I prefer to listen and then try on my own, because otherwise it's like copying things parrot-fashion and they don't sink in.

Researcher: I see.

Student: But the lectures make it possible to listen and then solving it is really great, it's the greatest.

Researcher: Okay. In connection with the rest of the things that were on the website … I have a question, at the beginning of the semester, when we studied Word, there was no NVSC yet, there were static screen prints and textual materials, was this good?

Student: The screen prints were good, but NVSC is preferable. No two ways about it, I would sit at home in front of the computer and it was like an entire lesson, it helps in a different way. In PowerPoint, for example, I found it much easier than with Word because when we studied PowerPoint you had already uploaded NVSCs.

Researcher: Only because of the NVSCs?

Student: Yes. And I have no idea about computers; I started at the level where I didn't know what keyboard keys were. And when I reached PowerPoint I found it really easy. I began to make presentations.

Researcher: Perhaps it's not precisely because of the NVSCs.

Student: It is because of the NVSCs, because the video brought the material into sharper focus. Word too I understood in the final analysis but today I know Word better because of my experience with the computer, because I do assignments, so I find it easier. But PowerPoint brought it into sharper focus for me, I found it easier. It was studying for a day and a half for the exam and I did not attend all the lessons because I already had recorded lessons, so everything flowed faster and in the PowerPoint exam I fared better even though it is in principle less easy.

Researcher: Okay, so you think that the materials on the website helped you in the exam?

Student: Yes. And I think that the studies in the course helped me in general, irrespective of the website. Today my knowledge is much better. I find things easier.

Researcher: I'm glad to hear that after the course your knowledge is much better.

Student: It's simply that I'm really terrible in computers. Nothing, I knew nothing before the course.

Researcher: Okay.

Student: And today I find myself working on the computer all day, because of Word. I know how to manipulate it, even with Excel, at work. Before this I didn't know any of this, I preferred to write everything by hand.

Researcher: Did you use the forum?

Student: Yes. At the forum there were a number of questions that you were asked about a few exercises, so I used it. But it was less clear.

Researcher: So did you ask a question?

Student: I didn't. I looked at the questions of others and based on this I learned too. You were asked about an exercise that others did not succeed in solving, so I learned from the answer.

Researcher: That's the idea; it's due to this that I said I preferred not to be asked questions by email. Because a lot of people have the same question and if the question is asked by email, I have to answer the same question many times. This way student can see how I answered the student who asked exactly the same question.

Student: On the website too; the same question was asked several times …

Researcher: True, but I am certain that I was spared a few repeat questions all the same.

Student: That is why from my point of view there was no point in asking questions because someone eventually asked all the questions that everybody had difficulty with.

Researcher: And ahead of the exam, when I agreed with you that I would be present at the forum at certain hours, I was at the forum a full two hours. Did you make use of this or did you only look on here too?

Student: No, I didn't make use of it.

Researcher: Did you come in at all during that time?

Student: No, not that I remember. I had a look at the questions afterwards … all the questions that I had difficulty with were answered so on the whole there was no problem. But mainly I made use of the NVSCs.

Researcher: This means that something can be learned from this? That is, from only watching the action being performed.

Student: Yes, this teaches one a lot, but in the final analysis even if I see what you have done, what matters is the formula that I will write in the formula row in Excel, that is, I will have to know how to solve it on my own.

Researcher: True.

Student: So this also teaches one how to solve a similar problem.

Researcher: So perhaps instead of NVSCs I could upload files and show you the solution, the formula?

Student: No, the NVSCs also provide an explanation. Because at times you see the solution but don't necessarily know how to arrive at it.

Researcher: What do I do in the NVSC? I do some keying in and you see the formula written.

Student: Yes, but I also hear the explanation. Not everyone can make the connection between the solution and the method itself. At times it is easier when you hear and see the solution. It's very individual, that's how it seems to me.

Researcher: Tell me another thing. How many times a week or month did you access the site? How frequently did you access the site?

Student: According to the exercises. I never accessed it of my own accord for no reason in particular.

Researcher: Didn't you access it to see if there were any messages?

Student: I see messages in the main portal. In the middle of the year you access the site only for a specific purpose, you don't access it just for the fun of it. Unless you have a lesson, a presentation that you want, some assignment to prepare, then you accesses it. On a daily basis it's less useful. Now we are visiting the site more often perhaps because of the exams, so we do see messages. Because in principle, we don't visit the site for no reason in particular.

Researcher: And did you do any optional exercises?

Student: Optional exercises? (hesitating)…

Researcher: There were two types of optional exercises, there were exercises of the type 'correct/incorrect' and multiple choice exercises and there were exercises like we did in class, files ….

Student: Right. I didn't do them. I didn't consider them relevant. There was another exercise in the optional exercises, which was modelled after the class exercises, which I did do. This is, for example, also an important thing to do – exercises. Because not everyone submitted exercises, for example – optional exercises are terribly helpful. Doing lots of optional exercises but only like the ones we did in class.

Researcher: Yes.

Student: So, for example, adding optional exercises is good because you can revise the material learned in the lesson.

Researcher: Afterwards I also added the solutions.

Student: Right.

Researcher: Did you make use of them?

Student: Yes.

Researcher: That is, exercises and solved exercises are material that helps?

Student: For me the website was really and truly helpful, both the NVSC and the solved exercise, everything really helped me. The textual explanations were in my opinion unnecessary, they were cumbersome, it's a lot to read five pages compared to all that you explain in the NVSC – there's a difference, the NVSC saves time.

Researcher: And the order in the site, that is, the fact that the site was arranged according to the sequence of the lessons and types of materials, divided into texts, static screen prints, abbreviated commands and NVSCs and also according to subjects related to the different programs. Was this clear?

Student: There was something cumbersome about this.

Researcher: How would you see it better? What would your personal preference be?

Student: Because I remember that someone from the second year also got into a fix, asking where to find something. So I told him more or less where and I went into the site myself to see the arrangement.

Researcher: What arrangement of materials would be the most convenient from your point of view?

Student: The best is according to the order of the lessons, because that way you know in which order to study, since in principle each lesson depends on another lesson. And if you don't understand one lesson then it's possible to go over the material from the lesson before it. That is why it should be done in chronological order of the actual lessons and not according to subject or material.

Researcher: Ah, in order to know in what order to work.

Student: Yes, because that is the best way to learn.

Researcher: I entered things both according to the lessons and according to subject. I assumed that according to the lessons it would be good for someone who has missed a lesson, allowing him to know exactly what material he has missed. And according to subject is good for someone who wants to review all the material.

Student: Yes.

Researcher: So that is why I put it in two formats, hence the duplication … because it was exactly the same material.

Student: Right. I remember that at first when I accessed the site it was cumbersome … there were lessons, there were NVSCs …

Researcher: Within each lesson there was a NVSC and there was written text.

Student: Is that so? So it's good you made a separation between the NVSCs and the text, it allowed me to directly access the NVSCs.

Researcher: So I shouldn't mix the two?

Student: Don't mix the two. Because each person likes a different form of study and it didn't suit me to learn from the texts.

Researcher: When you were preparing for an exam, did you study alone or in a group?

Student: No, alone.

Researcher: Don't you like studying in a group?

Student: No. In other subjects I studied in a group but specifically for this exam I studied alone.

Researcher: Why?

Student: Again, because I sat and listened to lectures since I did not attend lessons. You know, it's simpler to study this way … you sit at the computer and type, seems to me it's more complicated to study in twos.

Researcher: So why do you work in a group with other subjects?

Student: Because in other subjects we read the material to each other.

Researcher: Read to each other? Why?

Student: That is, we talk about the material, summarise it and talk about it, raise questions, just lecture to one another about the material. That's how we study.

Researcher: Do other lecturers have a website?

Student: No and that really has an adverse effect. But, for instance, mass media, political science, everything in communication … they as a matter of fact have a site. I studied only from presentations and this is the thing that most helped.

Researcher: So there are other lecturers with sites.

Student: No. Not everyone has a site. There are some who have a site and those who don't and this really affects the study. Because mostly everyone relies on the material of one person in class.

Researcher: What do you mean, one person, a student who takes notes in class and distributes it to all?

Student: Yes, right. For me personally, it is simply more convenient to listen than to write.

Researcher: In my lessons for example did you take notes?

Student: No, I only listened.

Researcher: Why? Because you knew it was on the website?

Student: That too. Specifically here I both knew it was on the website and I also understand better when I listen. That is, it's easier for me to listen than to write it all.

Researcher: That is, if the material was not on the website you would have to take notes?

Student: No. Then too I would not take notes.

Researcher: Then too you would not take notes? Then how would you review the material?

Student: I would photocopy it from someone. I have a good memory and I would also photocopy the material from someone, I would not take notes. I don't take notes in any subject, apart from statistics. You know, each person has his own habits … I am more attentive that way.

Researcher: How do you like to receive explanations, to read them or to have them explained orally?

Student: You mean explanations from a lecturer?

Researcher: Say I had to explain something to you; would you prefer to listen to me explaining it or also receive a sheet and see it written? Or read it to yourself and not listen to me?

Student: It depends on the subject. It's clearly always more convenient to listen and nicer to listen, it sinks in better than reading something. It is also more gripping to have someone sitting opposite you and talking, you have to be more attentive.

Researcher: I have a question. There are courses in which there is a tutorial session in addition to the lesson with the lecturer, right?

Student: Yes.

Researcher: What do you do with the tutor during the tutorial?

Student: We just go over articles with presentations.

Researcher: That is, if the lecturer asks you to read an article, you know that the tutor in the tutorial will summarise the article for you.

Student: Yes.

Researcher: Do you read the complete article afterwards?

Student: I cannot answer for the many …

Researcher: You?

Student: I personally do not read the article.

Researcher: Why, because the tutor summarises it?

Student: Yes, I also do not always go to the tutorials.

Researcher: Then I have a question. If the lecturer were to ask you to read the article and also give you his summary in written form, would there be a need for a tutorial? Is it important that the tutor summarise it for you orally?

Student: Yes, it adds. Firstly, it is additional knowledge that seeps in. Even if it is written, there's no two ways about it, when someone explains it to you orally, it sinks in and one asks questions.

Researcher: You ask questions?

Student: Yes. There are things that are not necessarily understood. When you ask a question you receive a more in-depth answer and that way you learn better. In mass media, for example, the tutorial is very helpful. That is, also the written material – for example, when I study from the site, from presentations, I am reminded of things that were said in the class. For instance, examples and all sorts of small things, although I don't write them down, when I read them I recall the things that were said in the class.

Researcher: Is it easier for you to remember something you heard than something you read?

Student: No, in both cases I am comfortable remembering. It is more convenient to relate certain situations to something I have heard.

Researcher: That you have heard?

Student: Yes, but from that point of view I can remember something that is written or something that is said, it makes no difference.

Researcher: And the fact that in my course there was a relatively well developed site, relative to others. Did this make you think that the course was on a higher level?

Student: It made me think that the lecturer was willing to make an effort.

Researcher: In other words, that the lecturer was more caring?

Student: Yes, with you the site is the most well tended.

Researcher: So what does this do for you? Do you study more seriously because of this? Or does it only make you hold the lecturer in higher esteem and that's all?

Student: It's more than esteem. It's easier to study, there's more of a will to study. The minute you don't have the material, the minute you have to search, it puts you off studying. The minute you come home and you know that you have the material it's much simpler. Otherwise I put things off. When I know that I have to go and photocopy, to go and get something instead of having the lecturer's material directly … it's easier for me to sit at the computer and start studying.

Researcher: In other words, this availability makes your learning more effective and also gives you greater motivation to study?

Student: Always. You come home no matter what time and you have the material. In contrast to material that you don't have and then you have to call people, ask questions.

Researcher: In other courses how would you want the site to appear, what materials would you want? In other courses they have no reason to make screen prints like in the computer literacy course. How would you want the site to look? Think about what you would want there to be in the site.

Student: I don't have to go out on a limb. PowerPoint presentations. Very simple. I studied according to presentations and got very good grades.

Researcher: But presentations are not detailed, they're headings.

Student: The presentations were slightly elaborated and apart from this, yes, we have to think for ourselves. You know there are certain points here that have to be gone over and thought to be developed according to the articles you read, according to your knowledge …

Researcher: According to the articles? Based on what I understood from you, you do this according to article summaries.

Student: According to the summaries, but, all the same, there are subjects where I read all the articles. Like mass media, where you have to submit assignments, so I did read all the articles. This is also the case if you have an assignment, so you read. In principle, I regard the presentations as a gift. So I learned all the material according to presentations and I did not get summaries from anyone.

Researcher: And did you print all the presentations for yourself or did you just see them?

Student: I only saw them on the computer. I saved ink.

Researcher: Well done. But would it have been more convenient for you if it had been printed, for example?

Student: The truth is that for a while I worked with printed presentations only. But afterwards I sat at the computer and I found it more convenient. I would download all the presentations directly to my desktop and that's all, without printing them … it's more convenient for me this way.

Researcher: Don't you want it printed to write your comments?

Student: No.

Researcher: And if this presentation had been delivered in the lesson when the lecturer would have used it?

Student: Ah, this is something that many people do.

Researcher: This means that the lecturers upload the presentations in advance.

Student: Yes. And this happened after numerous requests by us.

Researcher: You asked to have it uploaded in advance, in order to print it out?

Student: Yes. The problem is that they upload it only on the day of the course.

Researcher: Why?

Student: I don't know why.

Researcher: Are the lecturers afraid you won't turn up for the lesson if you know that the presentations are on the website?

Student: I don't know why. Everyone makes a printout before the lesson and comes to the lesson with the presentations. And they make comments on it. Because, when they don't bring them what happens in effect is that the lecturer stands and explains and then there are girls who have to copy the presentations, making him stop the whole class and delaying things. It's unnecessary, for instance, for people like me who want only to listen. The lecturer is delayed as well, he loses his train of thought because they spend every second copying the material. It's a disturbance.

Researcher: So it really is in the interest of the lecturer to give out printed presentations.

Student: Yes, giving it printed, yes.

Researcher: So actually you are referring only to presentations, nothing else? Would you want, for example, for every website to have a forum for you to ask questions?

Student: Yes, a forum is great. There are some that …

Researcher: But you say you did not use the website, only before an exam or exercise …

Student: Look, I did not use it, because there were already answers to questions that bothered me. I'm not going to ask the same question that has already been asked.

Researcher: But can you imagine a situation in which you need a forum in another course in which you would participate? The idea is an optional forum, not one in which the lecturer gives an article and says that on a certain day you have to meet and hold a discussion. I mean a forum that is on the website and when there are questions, they are asked.

Student: Yes, that's excellent.

Researcher: Yes?

Student: Look. Even when people asked questions, these were questions that did not occur to me and they raised them, so that's also something that helps me. Recorded lectures are also something that can help if they exist. Recorded tutorials are also excellent.

Researcher: But don't you think that if everything is recorded people won't go to the lessons?

Student: If a person does not want to go to the lessons he will not go whether they're recorded or not. It will not cause everyone to automatically not turn up for the lessons. This is also true of the presentations. What is written in the presentations is ultimately stated in the tutorials, so why do people continue to go to the tutorials? Whoever wants to, goes. It's like in the computer course, not everyone attended the lesson.

Researcher: True.

Student: And not on the knowledge that it was on the website. It makes no difference.

Researcher: Why did they not attend?

Student: Because not everyone attends all the lessons for all sorts of reasons, mostly because of other business.

Researcher: Is it the same people that do not attend all the lessons?

Student: Ultimately yes, I believe so.

Researcher: So do we have here people who have only registered and don't turn up? Are they virtual students?

Student: Not at all, but if you can get good grades without going to all the lessons and you understand the studied material, in the final analysis – otherwise I would not get this grade. And you have other obligations. Not everybody has the option not to work and to come here every day and whose parents are funding them and who live in their parents' home. I cannot. I have to finance both my studies and my rent. There are people who have obligations above and beyond these and this does not enable them to go to all the lessons. In any event it was a relatively demanding year, on the day we were to be there at 8:30 am it was a day that ended at 7 pm. And sometimes when we were with you in the afternoon, we would end at seven and there are people who have to go to work for the evening shift after a full day of studies. It's tiring and a reason to consider not going to the lesson. It's individual.

Researcher: Is it a help to working students that there are the websites?

Student: Certainly. For working students. There are also non-working people here and it's more convenient for them and there are those who work and can combine work and studies more easily. Each person chooses his own order of priorities. The one who works. The one who has obligations. So yes, it really helps.

Researcher: Another question. If you think that the materials the lecturers should upload to the website are presentations, then perhaps it is preferable that each lecturer at the start of the lesson distributes printouts to you and that's all. Why does one need a website?

Student: What do you mean?

Researcher: Why does one need a website?

Student: Because in the lesson they lecture with presentations.

Researcher: Okay, so let the lecturer give you the presentations on paper. Already printed so that there's no need for a website.

Student: Firstly, it's a waste of paper. Secondly, it's much more convenient because you work at home, you have the website, you access it.

Researcher: But what you have on the website are the presentation.

Student: Right, you access the presentations.

Researcher: So is it preferable for you for it to be on the website than in hand?

Student: For me personally it's more convenient.

Researcher: Why?

Student: I sit at home and open the website, that's the way I start to study, sitting in front of the computer. I don't know, perhaps it's a question of a habit that I developed.

Researcher: Yes? You prefer to read from the screen?

Student: Yes, I sit at home and I read all the material from the screen. But perhaps that's just me; perhaps there are some who find it more convenient to print. But that's the way I study, sitting, summarising if necessary in my own words, for me personally it's more convenient.

Researcher: Let's agree first of all on requests, assuming that I were able to forward your requests to other lecturers. What would I have to tell them? Please upload presentations?

Student: Yes, upload presentations to the website.

Researcher: And preferably to upload them before the lesson?

Student: Yes, before the lesson, so that also in the evening before the lesson it will be possible to read them, so you come to the lesson prepared. It's also a nicer feeling to know what the lesson is going to be about, that also helps. On the whole, recorded lectures, if it's possible to do this kind of thing, presentations are most important as far as I am concerned and study material of people, that is, also some initiative by some lecturer, with a diligent student sitting in the first row and then uploading materials to the site.

Researcher: You mean lesson summaries?

Student: Yes, in many places there are lesson summaries, generally an initiative on the part of some lecturer and student who upload summaries to the website.

Researcher: And that's good?

Student: It helps a lot … they also make a greater effort, work harder.

Researcher: Why do they make a greater effort?

Student: No, they simply post the summarised material, everything is written.

Researcher: The ones summarising put in more of an effort?

Student: Yes.

Researcher: Do they receive a bonus for this?

Student: Yes, I think a few grade points or something like that. One of the lecturers did this and he offered 10 bonus points. And then people show more willingness … because they also receive points for it. They also put in more of an effort, for example, someone who did this made a link to external websites where additional material could be found. It really helped.

Researcher: But did the lecturer go over the summary before uploading it to the website?

Student: No, it does not mean that the material is necessarily correct; it's simply the summary of a student. It also states that there is no guarantee regarding the material, if you want you can choose to learn from it, it's your responsibility.

Researcher: And has it happened that the same lesson was summarised by a number of students?

Student: Yes. Every lesson is summarised by two students.

Researcher: The same lesson? In other words there have been two different versions?

Student: Right and it comes without a guarantee. For this reason I say that if people do not attend the lessons, in the final analysis there are things that are said in the lesson that will never be written in the presentations. And there are things that are said in the lesson in a particular way and the person who writes them does so in his own words or they do not understand it the right way so it cannot be relied upon. That's the reason I study only from the presentations. The presentations always help because they are the lecturer's.

Researcher: Is this the message that I am supposed to convey?

Student: Presentations. Yes.

Researcher: And in my course, let's say, the computer literacy course. I teach a number of groups and there are other lecturers in the college who teach computer literacy. How do you think we should arrange the website for next year's students?

Student: First of all, recorded lectures are a must, in Word too if possible, because we had only static screen prints in Word and textual explanations.

Researcher: Okay. So I will add NVSCs for Word too.

Student: This is very helpful.

Researcher: Okay. And should the arrangement of the website remain the way it was?

Student: Yes, the way it was. And emphasise this in the lesson. I don't remember your saying this.

Researcher: Saying what?

Student: That there are NVSCs of lectures.

Researcher: In other words, I didn't market it well enough.

Student: No, you didn't market it well enough. Some of the students did not know about it. When I told other students, they were surprised because not everyone knew about it.

Researcher: This surprises me a bit because I mentioned it in every lesson. But okay.

Student: So perhaps they didn't understand that it was NVSC, they thought it was regular PowerPoint presentations. Because when I spoke about video demonstrations and told them how much they helped, there were some who said yes, I too heard it and it's excellent and there were some who did not know what I was talking about. So this is also something important, to market it more so people will know about it. So that they know that if there is a problem it will be possible to go to the site and see how to do it on an NVSC.

Researcher: I have a question. Can the forum be used for a virtual receiving hour? Can it provide an answer to this? Or is it better to come here and meet face-to-face if there is a problem?

Student: A virtual receiving hour. Seems to me that this would be preferable for a lecturer.

Researcher: I'm asking about you, not the lecturer.

Student: You get the same effect, you feel more comfortable asking, with a flexible timetable. Sometimes remaining here is not convenient, you know that a virtual receiving hour can be fixed for any time …

Researcher: But then it's in the forum, that is, everyone sees it. Is there a problem with this?

Student: There's no problem with this. I believe that if there is a personal question and it is important enough then a way will be found to come in person, but on the whole I don't think that it's a problem.

Researcher: So this means that it's worth saying. let's say, a virtual receiving hour every Monday from 5 to 7 pm?

Student: That's great. People can ask from home. That's really good.

Researcher: Okay. What else can be improved in the website?

Student: The truth is, in your course I don't know. For me personally, I don't see any way to improve it, perhaps adding more NVSCs. From my point of view if all the lessons were on video it would be great.

Researcher: The written texts, you say, are unnecessary?

Student: yes.

Researcher: You know that these texts, if you were to print them out, you would get a book. They are chapters from a book whose copyright I bought for use in our course.

Student: Yes, but I think that video lessons are preferable, at times to review what you did not understand in the lesson, to go over it at home before the assignment. All the lessons on video, if it were possible to make them more detailed … but that's surely a bit difficult …

Researcher: All the lessons on video? All the topics?

Student: Yes …

Researcher: Were there topics that we learned that were missing in the recordings?

Student: No, I would just be glad if all your lessons, in the way you explain them, could be recorded.

Researcher: And it was not that way?

Student: No, there were short examples.

Researcher: What do you mean? You mean a recording of the entire lesson as a video film?

Student: Yes, yes, yes. Is this something that's allowed?

Researcher: It's a regular video film, so what would one see? One would see me.

Student: Right, explaining. One has to hear you speak. Because you're talking about the subject, explaining and questions are being asked. If it is possible to do an upgrade, a combination of recordings of entire lessons that would be excellent.

Researcher: That is, you prefer there to be an entire lesson without interruption and not divided into short topics as in the NVSC?

Student: In the lesson there are always more answers, more questions that are asked. You always do a review of the homework, of all the stumbling blocks. Generally everyone had the same obstacles, the same questions ultimately, mostly very similar questions, which everyone had difficulty with in the homework. And so you provide a solution in the lesson and if it is recorded, that's good. There are things you also forget.

Researcher: Just a minute. Actually now that I think about it, just as I made the small recordings of the screen, I could record my computer for the whole lesson. You must see me too?

Student: No, hear you.

Researcher: Only hear me, right?

Student: Yes.

Researcher: So in fact I could leave the recording program active for an hour and a half?

Student: Yes and the student could fast forward items that are not relevant, it's not that you have no control, it's not that you are a slave to the screen. You can play with it, it's not something that disturbs you terribly or detracts.

Researcher: You know? that's a good idea. I could try this now with the summer group, I will simply record the entire lesson and see what happens.

Student: That's great. There's no doubt that an hour and a half is more comprehensive and more convenient to listen to, but in the final analysis you sit at home in front of your computer and you concentrate without a disturbance from the class. It's easier for you to understand the material, easier …

Researcher: But if I record the entire lesson then there is the disturbance of the class. I don't intend afterwards at home to go over the entire recording and remove the disturbances and dead spaces. That's too much work.

Student: Even with a recording of an hour and a half there will be a lot more material. In an hour and a half I could accommodate 5 lessons, each of an hour and a half, you can fast forward … everything will be clearer than going over written text material, because not everyone takes notes in a computer lesson, they usually only listen to you …

Researcher: Perhaps because everyone knows that there is the material on the website.

Student: No, it's simply because it's the kind of lesson where one listens. That's the way it seems to me because you always give class assignments, which is also great.

Researcher: Which assignments do you mean?

Student: All the business of doing assignments in class, it's important.

Researcher: And the fact that you could submit the exercises via the website, did this help you?

Student: And how! For example, today I came especially to the college to submit an assignment. It's unnecessary; if I could upload it to the site it would be simpler.

Researcher: Yes, but think of the lecturer, you are hundreds of students, you have to submit assignments, each one being tens of pages.

Student: No, 5-page assignments.

Researcher: Okay, 5 pages. The lecturer has to read it, not everyone likes to read from the screen, so he is compelled to print it out; someone has to print it out. It's not like in my lesson, where I have to see the digital file in any event, right?

Student: Yes, perhaps you are right.

Researcher: What else can be improved?

Student: On the whole, nothing occurs to me, for me again as I said to you, what would most help me are video lectures and if there were also the complete lessons it would be even better. Apart from this I don't think anything else is needed.

Researcher: In Word, to remind you, there was a document with abbreviated commands.

Student: Yes. And this also helped.

Researcher: In Excel there was no such document. Did you miss this?

Student: No, because there were the video lectures. You know what? I'm trying to think … yes, this could perhaps help in Excel.

Researcher: Yes?

Student: Yes. Because in Word too I went over this document and it helped me. It could help in Excel.

Researcher: That is, summarising how to do this and how to do that. What I understand is that you prefer the material to be in the style of 'how to'.

Student: Yes.

Researcher: Without too much text and examples, only how to do this and how to do that.

Student: Exactly.

Researcher: And you say that it is preferable that it be not only on video but also in text in summarised form according to steps 1, 2, 3 … without too many explanations.

Student: Right. Because the detailed explanations are just so much philosophising; difficult to read. It must be simplified as much as possible.

Researcher: But if one simplifies it you will be able to touch on only the simple things, because there's no room for explanations.

Student: I don't think so, for example, how did you explain the more complex formulas? It was quite simple.

Researcher: Right, in the NVSC I demonstrated it by examples, but when abbreviated commands are given it's a description of steps in a procedural manner, it's not examples.

Student: True.

Researcher: That's something else.

Student: I'm trying to think about it, there must definitely be a way to shorten and simplify the wording in Microsoft Help, definitely. I am one hundred percent sure that there are simpler ways … perhaps also the form, the manner in which it is written, the manner in which the page appears, perhaps it's also somehow that the design is problematic, I don't know.

Researcher: And the design of the texts in the e-book, which consisted of both explanations and screen prints? How was that?

Student: I don't know … either I was not concentrating on it or It was not clear from the outset so I left it and worked according to the NVSC … and that's it.

Researcher: Okay, apart from this is everything else just right?

Student: Yes. You know in the exam itself there was the part with the pie chart.

Researcher: Yes.

Student: The one with the bug, it's funny, because a week before this when I did an assignment I got stuck with the same problem, someone explained it to me, showed me how to fix it at home, someone who is not connected with the lesson. I said, okay, what are the chances that this will happen to me in the exam? And then it happened to me in the exam. It's something that you explained in one of the lessons, definitely, right?

Researcher: Right.

Student: You see? If it had been recorded I would not have faced such a problem. In the textual examples for instance it was not there, nor in the NVSC. And if I had not been in the lesson I would not have thought of it and since it happened to me at home, I ignored it because I said what are the chances that it will happen to me in class? What are the chances that I will hit a random key ... you understand? So for example this is something that could have been solved if it had been on the website. I am certain that half the class made this kind of mistake, not only me.

Researcher: True. Okay. If any other questions occur to me can I email them to you?

Student: Gladly.

Researcher: Yes? And you will answer me candidly, that is …

Student: Did you feel I was not answering you candidly?

Researcher: I expected to hear more constructive criticism for additional improvement of the learning materials.

Student: In my opinion you should continue with only the NVSC. It's something that you must market better during the course. For example, with the assignments, when you give an assignment, say okay guys there's recorded material on the website. People don't know this, people are really not aware of this, it's something new with us, in previous years there weren't such learning materials.

Researcher: People did as a matter of fact access the website in order to download assignments. And when entering the website, the first thing one sees is messages and every time I uploaded material on a new lesson I wrote in the messages that there was new material. Was even this not seen?

Student: It's difficult for me to answer for others; at times you are so intent on a particular goal that you don't see other things. It's nuts because it's in front of your eyes but you don't notice it. Even when there are messages in the portal you don't delve. The best thing is to send messages by email; everyone looks at their email even if it's once every two or three days. People mostly do look.

Researcher: Is it worth having it both by email and on the website?

Student: Look, if it's not difficult for you then it's clearly preferable.

Researcher: It's not difficult.

Student: So yes.

Researcher: In general do you think it's good to have a website accompanying a course?

Student: Certainly.

Researcher: In other words, it already seems to you that it's impossible to live without it.

Student: The college website is very important. I know that there are also people from other colleges who use our website.

Researcher: Which website?

Student: The law one, belonging to the Faculty of Law, because it contains good material, which can be downloaded.

Researcher: Good to know.

Student: Because it's open material.

Researcher: But with me, for example, you can access the site only with a password, as you know.

Student: Sometimes, as I said, I sat with someone who is studying elsewhere, to study for your exam. I said to him, 'Listen, get into the site', because I wanted to make things easy for him in the matter of recorded lectures. It's good, really a treasure. My friend studies at the university and she does not have such a site.

Researcher: She doesn't have one at all? It's possible she's in a course that has no site; you too don't have it in all your courses.

Student: Right, but she has no awareness of such a website at all. There is no awareness of an internet site as there is with us.

Researcher: And where did the awareness come from?

Student: Where did the awareness come from? I don't know if it came from anywhere, I think that the fact that you get in and see that it helps you gives you the awareness, the fact that people speak with you about the website – perhaps the awareness comes from this. See, I told people to study only through the NVSC, all the material is there on the site. People were enthused and saw that there really is material there.

Researcher: I have a question. The fact that in every lesson I got into the site, wrote messages and added material. Is it better than if the site had been prepared from the beginning of the year and I would say, 'This is your material and you will avail yourselves of it during the course'? Is the fact that the site was dynamic and changed every week, that is, that I was active with respect to the site throughout the semester; did it give one a better feeling?

Student: look …

Researcher: I'll tell you why I ask. This year I have already developed the materials, the site is already in existence and I can say to next year's students, here's the site, here's the material … I have nothing more to do with it, right?

Student: There's no reason why you should not be able to do this.

Researcher: In other words, it's not something that should bother them?

Student: No. Look, busy people have a thousand and one jobs to do. As I said to you, there's a daily agenda that includes studies, work, family, friends. So we are not preoccupied with this on a daily basis. It's not something that will make a difference, it's not something that will detract or add if there is the material in advance or if the lecturer adds it as the course progresses. It's only the level of effort and willingness. I believe that you don't have to prove yourself as regards the level of effort and willingness, because it's something that exists. It's something that the material is there; there is no need in my opinion.

Researcher: The fact that I made an effort, did it make you think that the course was a more serious one and as a result invest more effort in studying?

Student: To tell you the truth, I don't think so. You do hold the lecturer in higher esteem, but it's not something that makes you value the course itself more or less.

Researcher: It does not make you invest a greater effort? You don't say to yourself, this is a course in which an effort is being made and if the lecturer is making an effort then I will too?

Student: No, it's not something that makes you invest an effort.

Researcher: So perhaps just the opposite. Perhaps the fact that I made an effort and you knew that all the material is on the website made you say to yourselves, okay, we can rest assured?

Student: Yes, there is the possibility of complacency, no doubt about it, but again it's very individual. For instance there is a course which has no site with auxiliary material and nevertheless, people choose not to attend the lessons, so you see it doesn't matter whether there is a site with material or not.

Researcher: So what material is there in that course?

Student: Something someone in the class writes.

Researcher: There's no site or anything?

Student: There's only a book. So many people did not attend the lesson. One has nothing to do with the other in my opinion.

Researcher: How do you explain the fact that there were many who did not come to the computer lessons?

Student: Because not everyone is drawn to it. As I said, I for example with no background in computers – it makes your course of less interest to me. Obviously my lack of knowledge stems from a certain reason and there has been a lack of interest in me from the beginning, well before my studies. If I wanted, I would apparently learn. Here I learned from a lack but this choice helped me, there's no doubt. But if I had a choice today to take a computer course or not, I would not choose computers. With all due respect, the fact is that it does not attract me and like me there are many others, but there are those who already know. Now it's divided into two groups, there are those who are not interested and do not wish to know and those who deal with it daily at work and do know and then they are less interested in attending lessons. There is also a certain fear of computers, like a fear of maths. People are afraid of computers and from their point of view know nothing and will never know anything.

Researcher: By the way, have you noticed that there are links to sites in online courses, so that in fact you could study on your own?

Student: I haven't seen this.

Researcher: And if you had seen them, would you sit and study on your own?

Student: I would prefer to listen to you than listen to a different lecturer.

Researcher: Another thing, do you remember that at the beginning of the course I taught the concepts associated with the computer?

Student: Yes.

Researcher: After the lesson I uploaded to the site a document that summarised all the concepts we talked about in the lesson. Also, in the same place I also added a folder for enrichment. For example, if there was a certain concept, the hard disk, the enrichment folder had a link to a site that showed a picture of a hard disk with animation or simulation by way of illustration. Did you access the enrichment folder?

Student: No.

Researcher: Why?

Student: Because it does not interest me.

Researcher: Because it was for enrichment only?

Student: Students mostly do not enrich themselves; they want to focus on finishing the year, the degree, passing and going on. Students do not come to learn and enrich themselves, they come to do the assignments that are required of them and do not look beyond that. It's sad but that's simply how it is.

Researcher: How would you prefer the lesson to be delivered, for the lecturer to ask a question, stimulate some discussion, speak to you, let you develop the theme, raise a dilemma, refer you to reading material, research work as it were? Or for the lecturer to come with a prepared lecture, speak for an hour and a half; tell you everything you need to know on the subject?

Student: I personally prefer the discussion, the question that is asked, perhaps the curiosity that develops as a result; perhaps it is something that could guide me. The minute you are curious, the minute there is a discussion in class, a question is asked and it is automatically something that results in greater attentiveness, a greater will to participate.

Researcher: And does one learn more or less from this?

Student: One learns also from a lecture, but the minute you are part of an interaction there is no doubt that you internalise much more.

Researcher: But not always what you find on the internet or what another student says is accurate information.

Student: Certainly, but there is a lecturer who steers us, it's not a discussion we conduct between us on the bench outside. There is after all an authoritative figure who knows what is right and what is wrong and he directs the discussion.

Researcher: So you prefer to study this way, it's more interesting?

Student: Yes, also in the final analysis, the subject matter of communication is so many theories, there's no right and wrong, there's a little from here and a little from there and an integration of everything together. For this reason I don’t think that one can go terribly wrong.

Researcher: But in computer applications is there a room for such a discussion? In the manner of for and against?

Student: No, I don’t think so. In computers it's knowing, it's learning this and that's all. Just a skill. There are subjects where one simply must know the material and that is all, there is no curiosity beyond this because you simply have to know it.

Researcher: Okay, you have been a great help. If you remember anything else I would be happy to hear from you.

Student: Gladly and if you have any more questions I would be happy to answer them.

Researcher: Thank you very much.

Appendix A- Widening participation in Israel

The 1990s witnessed expansion of the HE system in Israel with a view to allowing access by groups and sectors that had not been entitled to do so in the past (including residents of peripheral areas, groups with Asian and African backgrounds, the ultraorthodox and Arabs). As a result, the number of students learning in HE institutions increased and since the early 1990s, the number of candidates for bachelor's degree studies in universities in Israel showed a generally increasing trend. In 2008, 66 institutions of HE operated in Israel including universities, academic colleges receiving a budget from the Planning and Budgeting Committee (PBC), private academic colleges that do not receive a budget from the PBC and teacher training colleges with some 220,470 students. (In addition to these, 44,330 students studied in the framework of the Open University). The most significant factor enabling accessibility to HE in Israel is the existence of private and public colleges, where most of the students study towards a bachelor's degree (Kirsch, 2010).

In the wake of this decision, a considerable increase was seen in the number of colleges awarding academic degrees. The system of HE in Israel, which was once wholly public, became partly private. Despite the academic nature of the new colleges, they have been considered from the time of their establishment as a second level system in HE. This stems to a great extent from the policy of the Council for Higher Education (CHE), which defined the colleges as teaching institutions rather than research institutions, restricting them to studies towards a bachelor's degree only (Volansky, 2005).

Private colleges that are not funded by the PBC generally admit candidates with lower qualifications, which is a great advantage for these candidates; in parallel, however, the tuition fees are at times higher, which is clearly a disadvantage. However, the increase in the number of private colleges, which are more expensive, could also present new opportunities to affluent members of society who have relatively lower academic qualifications. In other words, widening of the private HE system can not only perpetuate inequality in education but also widen the inequality gap due to financial difficulties (Callender and Jackson, 2005; Ayalon, 2008)

The support model developed by the Steering Committee on the subject is based on the provision of incentives to institutions of HE for activities geared to increasing the number of students from minority groups, reducing the dropout rate, improving achievements and raising the number of students studying towards higher degrees.

The perception of the new colleges as a second level in the HE system has been reinforced by their admission policy: the admission requirements of colleges in all fields of study are lower than those of universities (Ayalon and Yogev, 2005). Some institutions do not require a psychometric test grade and are satisfied with a matriculation certificate; even in colleges that do require a psychometric test, the minimum accepted grade – which is the weighted average of the mean matriculation grade and the psychometric test grade – is lower than that required by universities in the corresponding fields (Ayalon and Yogev, 2002).

Among the private academic colleges are also specialised colleges that focus on a prestigious discipline that is in demand, such as law or business administration. These specialised colleges enjoy a superior status, while their admission requirements are also relatively high. They are considered, thus, to be on a par with universities from the point of view of their entrance requirements, despite being part of the second level in the HE system.

Because of the high costs involved, private colleges seek to attract the well-to-do population *vis-à-vis* the public colleges, whose target population is the weaker segments of society. Contributing, moreover, to the perpetuation of class inequality is the fact, that the private colleges offer disciplines in demand that ensure high returns in the labour market whereas the public colleges offer less well-paid fields. This shows that an attempt to examine the implications of expansion and variation in the HE system in Israel in terms of social inequality, should not be confined to the dichotomy of colleges *versus* universities, but should also take into consideration the types of colleges and in particular the distinction between public and private colleges (Ayalon, 2008).

It was found (Ayalon, ibid), that the average acceptance grade for students of European and American background, is higher than that for students of Asian and African origin; the average acceptance grade for residents from central Israel is higher than that for residents of peripheral areas; the average acceptance grade for men is higher than that for women; and the average acceptance grade for students from high-income families is higher than that of students from less wealthy homes. The greatest gap is seen in the distinction made with respect to the educational level of students' parents: the acceptance grade for offspring of academic parents is considerably higher than that for children of parents who do not have an academic education. Because of their lower academic qualifications, children of non-academic parents prefer academic colleges to universities to a greater extent than their counterparts with a higher educational level.

A common index for examining accessibility to HE is the ratio of new students who are commencing their studies in an institution of HE to the annual average of 20-24 years old, the age group in which most students begin their studies. At the beginning of the 1990s, this ratio stood at 23%, rising steadily to 36% in 2000 and reaching 43.6% in 2004. In 2005, the ratio dropped for the first time since 1990, to 41.8%, but then resumed its climb in the last years. Today Israel is conspicuously ahead with respect to the proportion of persons joining the institutions of HE as well as the proportion of academics. The percentage of people entering the HE system in Israel stood at 60% in 2008 *versus 56%* on average in all the OECD countries. This figure has been on the rise and since 2008 has grown by 10% (Kirsch, 2010).

Appendix B – OER licensing

Hilton III, et al. (2010) refer to the four Rs, which according to them are essential to the nature of OER:

- Reuse: the right to use the learning material in its given form.
- Revise: the right to edit and incorporate adjustments.
- Remix: the right to append the learning material to other materials.
- Redistribute: the right to share the learning material and its adapted products with others.

However, there is still an ongoing debate around the implementation of these rights. The nature of the arguments raging around the subject of licensing for OER is to what extent is an open license really open. The question of freedom and the unclear definitions of open access and free access became an issue from the moment free and open source software began to be offered, namely, in 1983. The concern then was the freedom to use software, to learn how the software works and adapt it to local needs, to redistribute the software, to improve it and to disseminate the improved version to the public at large. These disputes have entered the domain of OER, with the new, additional aspect of freedom that did not exist earlier, namely, cost (Campbell, 2003; Duncan, 2003; Littlejohn, 2003; Duval, et al. 2004; Wiley, et al., 2012). Many people who advocate use of OER claim that an outstanding advantage lies in the fact that they are free of charge and can be downloaded at will. The question of this freedom, however, is unclear: it still does not mean, for example, that the educators are free to upload open materials to their server for the benefit of their students. A common error is the assumption that an open license is no different from public domain, the latter meaning that the creator has waived all rights to the learning material. In actual fact, an open license is intended to protect copyrights on the Internet.

Since copyrights restrict the reuse of learning materials, the format of Creative Commons (CC) has been proposed in order to allow teachers to use and share learning materials that are protected by copyrights, but in a way that allows its worry-free use.

The principal concern of educators in the context of OER is, in general, the surrender of intellectual property and the relinquishment of possible commercial profit from it, but, in particular, the unfair use that could be made of their intellectual property and the possible financial gain from it by others. The definition of 'fair use' is also not clear and is determined on a case-by-case basis drawing on four factors:

1. The purpose of the use is for non-profit;
2. The nature of the original work is primarily non-fiction;
3. The amount of the portion used in relation to the original work as a whole is small;
4. The use does not harm the value of the original work in the market; (Columbia University, n.d.).

The approach of Creative Commons (CC) is to offer open licenses to digital materials that are adapted to the individual requirements of the person who created them, as detailed on the CC website (Creativecommons.org, n.d.). Different levels exist in the granting of rights to use learning materials: some allow copying while others allow adaptation and modification. Thus, in principle, authors who apply CC are in fact, interested in maintaining their rights, but agree to waive some of them in accordance with the definition of the license that they choose to use. The various restrictions are:

Attribution (BY) - The owner lets others copy, distribute, display and perform the copyrighted work — and derivative works based upon it — but only if they give credit the way the owner's requests.

Share Alike (SA) - The owner allows others to distribute derivative works only under a license identical to the license that governs the original work. This clause is also called 'copyleft'.

Non-Commercial (NC) - The owner lets others copy, distribute, display and perform the original work — and derivative works based upon it — but for non-commercial purposes only.

No Derivative Works (N.D.) - The owner lets others copy, distribute, display and perform only verbatim copies of the original work, not derivative works based upon it.

Thus, licenses on digital items may appear in various combinations of the above clauses.

One license that is more controversial than the others is the non-commercial (NC) license. (Commonwealth of Learning, n.d; Hofman and West, 2008; Rutledge, 2008). A number of interpretations have been given to the restrictions attached to NC, the most stringent being that money should not change hands as part of the use of OER. However, Hofman and West (2008) state that other possibilities exist, for example, when monetary compensation is granted for expenses. In principle, the action is considered to be commercial only if it has been carried out with a prior profit-making intention in mind. Thus, according to Rutledge (2008), monetary compensation for expenses incurred is not regarded as commercial use. The term 'prior intention' is in itself open to many interpretations – hence, the differences of opinion in connection with the term, including whether NC clause is required at all since, for example, such a license can prevent an educational institution that charges for its courses from using OER that are NC. An additional claim against an NC license is that learning materials under this license are not compatible with learning materials that do not have this restriction, as exemplified by Bissell and Boyle (2007) and then a restriction arises with respect to reusability and the integration of a number of materials having different licenses.

Another advocate of the redundancy of an NC license is Wiley (2006; 2012), who suggests that if the learning material is found freely on the Internet, there is, in any event, no significance to the fact that someone has decided to collect money for it. On the other hand, if someone altered the material, thereby allowing the original material to gain added value by upgrading it, it is his/her right to charge for it. However, if the original material is also under an SA license, the person who upgraded the learning material will not be able to disseminate it under an NC license because of the SA license restrictions. According to Wiley (ibid), the NC restriction is an impediment to the distribution of OER, because the more restrictions there are, the fewer the people who will use open materials, for fear of violating the law, or they will need to make an extra effort, involving payment, to verify their rights, eventually resulting in fewer users. He is of the opinion that CC-BY-SA is sufficient. .

In opposition to Wiley's opinion, Downes (2012) claims that an NC restriction is necessary for practical reasons since economic agencies that are involved in the sale of materials will try to limit the distribution of free versions of the materials. They will, in particular, try to limit the community's ability to reuse it, make adaptations and redistribute the materials; thus, in such a situation, where there is no NC restriction, the focus shifts to content suppliers, whose interests OER begin to serve rather than those of the learners. Once NC exists and no economic interests are involved, the focus shifts to the learner. According to Downes (2011) the principal users of OER are students, who in any event have no intention of making commercial use of the materials, such that an NC clause will not deter them. Should an NC clause deter companies, even non-profit ones, from using the materials, this would be a secondary issue because it is more important to prevent publishers and other companies from making such material commercial.

Appendix C - Examples of OER repositories

Examples of OER repositories:

- OpenLearn (OpenLearn, 2013)
  OER University (OERu, 2011)
- ARIADNE- Alliance of Remote Instructional Authoring and Distribution Networks for Europe (ARIADNE, 2012);
- MERLOT - Multimedia Educational Resource for Learning and Online Teaching (MERLOT, n.d.)
- Celebrate - Context eLearning with Broad Band Technologies (Celebrate, n.d.)
- MAOR - Meta-data and Object Repository (MAOR, n.d.)
- CETL-Reusable Learning Objects (CETL, 2009)
- JORUM –(JORUM, 2013)
- YouTube – (YouTube, 2013). The infrastructure for sharing video. YouTube content provides an additional framework for openness and partnership with respect to video content, including learning content, through the educational channel as well as a dedicated channel for teachers who wish to incorporate in their teaching video content that was developed by them or by others, including clips such as NVSCS that were used in the course of the present research. (YouTube, n.d.)

In order to support LO repositories a need arose to develop cataloguing models allowing efficient access to the materials (CISCO systems Inc, 2000; IEEE, 2002a; ISO, 2003).

Examples of such models include:

IEEE LOM (Learning Object Metadata)*;* this is a model that serves for cataloguing digital learning resources of the LOs type. The purpose of the model is to support the reusability of LOs and improve the efficiency of their search-and-find function and use, which is generally done in the context of LMS (Learning Management System). Standard IEEE LOM, published by the Institute of Electrical and Electronics Engineers Standards Association, New York, allows a description of the relevant features of LOs, such as author, owner, type of LO and its pedagogic aims (IEEE, 2002b).

SCORM (Shareable Content Object Reference Model); this is a collection of standards for storage and use of LOs on the web. It is a model that defines the links between the user and the environment in which the LOs are stored, these generally being LMS systems (Borsook and Higginbotham-Wheat, 1991; Barker, 1994; Sims, 1997; Chou, 2003).

IMS (Instructional Management Systems); this is an additional model of standards for storing, locating and using LOs (ImsGlobal Learning Consortium, n.d.)

ISRACore; Israeli Standard for characterisation of LOs based on LOM (Learning Object Metadata), which is commonly used in Europe for metadata for LOs (IUCC, n.d.).

Most of the LMSs that are used in systems of Higher Education for the purposes of virtual study or as support for blended learning are based on the above-mentioned standards.

Examples of such LMSs include:

- Blackboard (Blackboard, n.d,)
- WebCT - currently owned by Blackboard ;
- Moodle (Moodle, n.d.);
- HighLearn, which is being used in Israel (Britannica, n.d.);

Most of the systems allow interoperability and the sharing of LOs between the systems that use the various standards.

In addition to the LO repositories, many Universities offer open course initiatives, which also contain MM learning materials for the free use of interested teachers and students, as exemplified by the following:

- MIT–(MIT opencoursware, n.d.);
- Berkeley–(Webcast.Berkeley, 2013);
- Michigan–(Open.Michigan, 2013);
- Carnegie Melon -(OpenLearningInitiative, 2012);
- Others in the Top 40 Sources for Open Courseware Videos –(Knowledge Knuggets, 2010);

Examples of OER search engines:

- GeoNetwork Opensource – (GeoNetwork Opensource, 2013);
- Open Courseware Consortium- (Open Courseware Consortium, 2013.);
- OER Dynamic Search Engine - Edtechpost, 2013);
- Curriki's Blog- (Curriki's Blog, 2013);
- Creative Commons Search- (Creative Commons Search, 2012);

OER repositories in Israel

The process of opening up learning content has been ongoing for more than a decade throughout the world. In Israel, however, the field is still in its infancy, although it is already possible to identify several interesting and promising open content repositories.

- Snunit, the oldest content website in Israel for children and youths, was set up in 1994 as a project by the Hebrew University of Jerusalem. In 1999 it became an independent non-profit organisation, although some of the content offered on the website is for pay (Snunit, n.d.).
- The website of the Study Planning Centre (MATAL) at the Kay College of Education maintains a compilation of teaching and learning materials, both in printed and digital form. The educational repository on the Internet contains learning materials in Hebrew and Arabic, including original articles and works written by students and teachers from the college, as well as numerous links arranged according to fields of interest (MATAL, n.d.).
- An additional initiative is that of MOFET (school for research and development of training programs for educational and teaching staff in colleges), which maintains a portal known as Masa-Mofet Around the World that includes pedagogic content specialising in teacher training. The portal, which was set up in 2004, contains valuable information that is of vital importance to educational staff, professionals specialising in teacher training, heads of colleges, university lecturers, students and others. (MASA, n.d.).
- The Open University of Israel initiated a move known as PE'ER to open up free electronic audio learning materials and books. PE'ER allows free access to textbooks and teaching materials developed by the Open University in a range of courses and subjects. The content is intended for all Hebrew readers in Israel and elsewhere and can be enjoyed by lecturers, students, teachers, researchers and others. An audio version has been added for some of the books for access via the Internet or for downloading to mobile music players. As regards books, these include publication of lectures and videos featuring authors or content specialists. In addition, PE'ER boasts an extensive repository of more than 6,000 digital LOs that were developed by the university's teaching staff. However, these LOs have been accessible till the present time only to its students (PE'ER n.d.)
- The Ministry of Education, the Israel Internet Association and the Interuniversity Computation Centre came out with a joint initiative, MAOR (Meta-data and Object Repository), to develop an in-house repository for studying on the Web. MAOR's aim

is to assist in the location of quality study resources existing online. The repository documents educational and study resources through a structured mechanism comprising labels and links to facilitate search and features collaboration with the student community and evaluation by professionals. The repository is based on MERLOT and includes more than 3,000 LOs in a variety of subjects (MAOR, n.d.).

- An additional repository that was set up recently, the educational content portal of the Israel Ministry of Education is part of the national ICT program for creation of a digital content portal. The aim of the portal is to compile items of information and teaching materials while classifying them according to subject. The site is linked to materials that were developed by the Ministry of Education, by teachers and by commercial entities (use of part of which is for pay). With the help of this portal, the Ministry of Education hopes to provide answers to the teacher who does not necessarily have technological skills. In parallel, teachers are encouraged to create open learning content for pay (Ministry of Education, n.d.).

Appendix D- Production of Narrated Video Screen Captures

For the purpose of the ***computer literacy*** course, the NVSCs were produced using MS Producer^{TM}, a program of the video capture type. The program enables capture of the activities taking place on the computer screen and concurrent recording of the teacher's narration explaining the various operations. The product is saved as a WMV file for viewing with the help of any media player such as Windows Media Player^{TM}, Real Player^{TM}, etc.

These LOs are not recorded during the lesson and do not contain complete lectures but rather segments, each of which including a single subject selected from the studied material. In order to cover subjects taught in a single lesson, separate video segments have to be integrated: these are, in fact, LOs, that are storable in a repository and are reusable each time in a different sequence (unlike lecture capture, in which the lecturers automatically record the entire lecture).

The LOs are uploaded to the LMS virtual learning environment that was constructed in the HighLearn system, an LMS that is used by many academic institutions in Israel. The system was developed for Israel's educational system in 1980 by Britannica Knowledge Systems, which was established as part of the Centre for Educational Technology and has since 2001 been owned by Encyclopedia Britannica Inc. of the USA.

The environment that was constructed for the course included a system for notices, a system for submission of tasks and a system for uploading learning materials. The NVSCs are stored in the knowledge repository of the course. The environment was constructed to provide support to students studying according to the traditional frontal method, with the study materials in the virtual learning environment serving them as optional auxiliary materials, intended for revision of the material covered in the classroom and for supplementary independent learning where the student was absent from the class lesson.

Usually during the course, the NVSCs are uploaded at the end of each lesson, with each group having its own virtual environment. The uploaded NVSCs are adapted to the material that was taught in the classroom to the specific group in the specific lesson. Such an organisational structure of NVSCs arranged according to the order of the lessons is desirable for students since it allows them to revise the material that was covered in a specific lesson or catch up a lesson that was missed. At the end of the course and ahead of the examination, the NVSCs on the subjects studied during the course are presented according to subject as well (e.g. a folder containing commands for editing a document or a folder containing commands for editing tables etc.). The division of video segments into nuclear subjects is highly convenient for students, allowing them to view only those subjects in which they feel unsure, according to a sequence that suits them according to their needs at the time.

A video segment is created for each skill, such that the segments can be incorporated in any desired order. Interactivity in the NVSCs is manifested in the ability on the part of the students to control the Windows Media Player program (or any other similar program chosen by them to view the video). That is, stop the screen capture, fast forward and backtrack, in order to view it again as many times as they want, in order to go over explanations in parts where they were not clear to them, or to stop it, in order to write notes. The mouse cursor serves as pointer. It is seen on the screen throughout the explanation and it helps to follow the operations. Visual material includes the relevant screen images and menus. The teacher is not seen and besides the audio narration, there are no additional textual explanations.

Appendix E - Motivated Strategies for Learning Questionnaire (MSLQ)- Test Anxiety questions (and socio-demographic questions)

Dear students,

I would appreciate if you answer the following questions:

In the table below, there are a few statements. Please circle the number that represents best what you feel. There is no right or wrong answer. Relate just to what you feel.

	not at all true						very true
1. When I take a test, I think about how poorly I am doing compared with other students.	1	2	3	4	5	6	7
2. When I take a test, I think about items on other parts of the test that I can't answer	1	2	3	4	5	6	7
3. When I take tests, I think of the consequences of failing	1	2	3	4	5	6	7
4. I have an uneasy, upset feeling when I take an exam	1	2	3	4	5	6	7
5. I feel my heart beating fast when I take an exam	1	2	3	4	5	6	7

Some more questions:

1. You gender:
    1. Male
    2. Female
2. Born in Israel
    1. Yes
    2. No
        1. More than six years in the country
        2. Less than six years in the country

3. Family status
    1. Single
    2. Married
4. Number of children_____
5. Occupation
    1. Full time
    2. Part time
    3. Unemployed

6. In case of missing classes the reason was (chose the predominant one):
    1. Job obligations
    2. Family obligations
    3. Reserve duty
    4. Sickness
    5. Other____________________
7. What was your Matriculation examination score______

Appendix F -Designing a multilevel list- a task related to MS Word™

Part 1 (the recall part of the experiment)

Id no.________________

A. Please answer the following questions:

- Word allows up to _____ levels in multilevel lists
- In order to increase the level of an item on a multilevel list one has to press the ____ button.
- In order to decrease the level of an item on a multilevel list one has to press the ____ button.
- What happens if the level of the first item on the list is increased?
- Does any number style allow including level number from previous level?
    1. Yes
    2. No- if you chose ' no' -what numbering format does not allow inclusion of previous level number? _________

B. (students opened templates with ready unformatted lists)

Please note: before you start formatting your list save the ready template under your id number (students opened templates with unformatted lists)

Format the following list as shown on your page:

Sports management work strength:

Original List provided to students	**Output list- expected to be done by student**	**Element interactivity-list of actions taken by the student to get to the output list**
Kick-boxing	{A.} Kick-boxing	1 Highlight the list items
Management members:	(I) Management members:	2 Start a numbered list
National team		3 Leave item 1 at level 1
Ronen	a. National team	4 Increase item 2 to level 2
Dina	⚐ Ronen	5 Increase item 3 to level 3
Local team	⚐ Dina	6 Increase items 4&5 to level 4
Lavi	b. Local team	7 Increase item 6 to level 3
Reuben	⚐ Lavi	8 Increase item 7&8 to level 4
Players	⚐ Reuben	9 Increase item 9 to level 2

Original List provided to students	**Output list- expected to be done by student**	**Element interactivity-list of actions taken by the student to get to the output list**
Ronen nava Body building Management members National team Levana Ravit Local team Tzchori Vardi Players Tzipi Shula	(II) Players a. Ronen b. nava {B.} Body building (I) Management members a. National team ⚐ Levana ⚐ Ravit b. Local team ⚐ Tzchori ⚐ Vardi (II) Players a. Tzipi b. Shula	10 Increase item 10&11 to level 3 11 leave item 12 at level 1 12 Increase item 13 to level 2 13 Increase item 14 to level 3 14 Increase item 15&16 to level 4 15 Increase item 17 to level 3 16 Increase item 18 &19 to level 4 17 Increase item 20 to level 2 18 Increase items 21 &22 to level 3 19 Highlight the list 20 Click the multilist drop-down arrow to choose a different multilevel list styles 21 Choose ' define new multilevel list' 22 Select 1 in the ' click level to modify list' 23 Choose number style for this level (A,B,C….) 24 Enter formatting for number ({}) 25 Select 2 in the ' click level to modify list' 26 Choose number style for this level (I,II,III….) 27 Enter formatting for number (())

Original List provided to students	Output list- expected to be done by student	Element interactivity-list of actions taken by the student to get to the output list
		28 Select 3 in the ' click level to modify list' 29 Choose number style for this level (a,b,c….) 30 Enter formatting for number(.) 31 Select 4 in the ' click level to modify list' 32 Press the number style for this level drop-down arrow 33 Press ' new bullet' 34 Press the font drop-down arrow 35 Go to wingdings 36 Choose the flag symbol (⚐)

C. Please note: before you start formatting your list save the ready template under your id number.

Format the following list as shown on your page:

Lecturers list

Original List provided to students	**Output list- expected to be done by student**	**Element interactivity-list of actions taken by the student to get to the output list**
Yahalom college Social science B.A. Dr' shani Dr' levi M.A. Dr' Cohen Computer science B.A. Dr' Shapira Dr'stav Hashalom College Social Science B.A. Dr' Livne Dr' Kaspi M.A. Dr' Tzchori Dr' Zehavi	{A.} Yahalom college A.(I) Social science A.I.a. B.A. ⚐Dr' shani ⚐Dr' levi A.I.b. M.A. ⚐Dr' Cohen A.(II) Computer science A.II.a. B.A. ⚐Dr' Shapira ⚐Dr'stav {B.} Hashalom College B.(I) Social Science B.I.a. B.A. ⚐Dr' Livne ⚐Dr' Kaspi B.I.b. M.A. ⚐Dr' Tzchori ⚐Dr' Zehavi	1. Highlight the list items 2. Start a numbered list 3. Leave item 1 at level 1 4. Increase item 2 to level 2 5. Increase item 3 to level 3 6. Increase items 4&5 to level 4 7. Increase item 6 to level 3 8. Increase item 7 to level 4 9. Increase item 8 to level 2 10. Increase item 9 to level 3 11. Increase item 10&11 to level 4 12. leave item 12 at level 1 13. Increase item 13 to level 2 14. Increase item 14 to level 3 15. Increase item 15&16 to level 4 16. Increase item 17 to leve 3 1

Original List provided to students	Output list- expected to be done by student	Element interactivity-list of actions taken by the student to get to the output list
		17. Increase item 18 &19 to level 4 18. Highlight the list 19. Click the multilist drop-down arrow to choose a different multilevel list styles 20. Choose ' define new multilevel list' 21. Select 1 in the ' click level to modify list' 22. Choose number style for this level (A,B,C….) 23. Enter formatting for number ({}) 24. Select 2 in the ' click level to modify list' 25. Choose number style for this level (I,II,III….) 26. Enter formatting for number (()) 27. Press the drop-down arrow of ' include level number from' and choose ' level 1' 28. Separate the levels numbers with a dot 29. Select 1 in the ' click level to modify list'

Original List provided to students	Output list- expected to be done by student	Element interactivity-list of actions taken by the student to get to the output list
		30. Choose number style for this level (a,b,c….) 31. Enter formatting for number(.) 32. Press the drop-down arrow of ' include level number from' and choose ' level 1' 33. Press the drop-down arrow of ' include level number from' again and choose ' level 2' 34. Separate the levels numbers with a dot 35. Select 1 in the ' click level to modify list' 36. Press the number style for this level drop-down arrow 37. Press ' new bullet' 38. Press the font drop-down arrow 39. Go to wingdings 40. Choose the flag symbol (⚐)

Save this part with your formatted lists, fill the following questionnaire (Appendix J) and continue to part 2

Part 2 (The transfer part of the experience)

A. Change the format of the following list according to the format shown on your paper;

<u>Activities list</u>

Original List provided to students	**Output list- expected to be done by student**	**Element interactivity-list of actions taken by the student to get to the output list**
{a.} Chess	{A.} Chess	1 Highlight the
(I).a Guides	(1). Guides	formatted list
a.I.1. Senior gudes	a. Senior gudes	2 Click the multilist
🕮 Sima	⚐ Sima	drop-down arrow to
🕮 dina	⚐ dina	choose a different
a.I.2. New guides	b. New guides	multilevel list styles
🕮 Lavi	⚐ Lavi	3 Choose ' define new
🕮 chedva	⚐ chedva	multilevel list'
(II).a Students	(2). Students	4 Select 1 in the ' click
a.II.1. new students	a. new students	level to modify list'
🕮 nurit	⚐ nurit	5 Choose number style
🕮 yulia	⚐ yulia	for this level
(III).a senior students	b. senior students	(A,B,C….)
a.III.1. reuben	⚐ reuben	6 Leave number
a.III.2. shimeon	⚐ shimeon	format as is ({})
{b.} Ball room dancing	{B.} Ball room dancing	7 Select 2 in the ' click
(I).b Guides	(1). Guides	level to modify list'
b.I.1. Senior guides	a. Senior guides	8 Choose number style
🕮 Levana	⚐ Levana	for this level
🕮 dorith	⚐ dorith	(1,2,3….)
b.I.2. New guides	b. New guides	9 Leave number
🕮 Shosh	⚐ Shosh	format as is (())
🕮 vardi	⚐ vardi	10 Erase number and
(II).b Students	(2). Students	format from level 1
b.II.1. new students	a. new students	at the formatting
🕮 nurith	⚐ nurith	window.
🕮 yulia	⚐ yulia	11 Select 3 in the ' click
(III).b senior students	b. senior students	level to modify list'

Original List provided to students	Output list- expected to be done by student	Element interactivity-list of actions taken by the student to get to the output list
📖 reuben 📖 shimeon	🏳 reuben 🏳 shimeon	12 Choose number style for this level (a,b,c….) 13 Enter formatting for number (.) 14 Erase number and format from level 1 and level 2 at the formatting window. 15 Select 4 in the ' click level to modify list' press the number style for this level drop-down arrow 16 Ppress ' new bullet' 17 Ppress the font drop-down arrow 18 Ggo to wingdings 19 Cchoose the flag symbol (🏳)

B. Change the format of the following list according to the format shown on your paper;

Olympic Games

Original List provided to students	**Output list- expected to be done by student**	**Element interactivity-list of actions taken by the student to get to the output list**
{a.} light athletics (I).a. morning a.I.1. men 🕮 ronen 🕮 shalom a.I.2. women 🕮 ruchama 🕮 shani (II).a. evening a.II.1. men 🕮 avi 🕮 yossi {b.} 100 meter run (I).b. Morning b.I.1. Men 🕮 Amit 🕮 Eran b.I.2. Women 🕮 Revital 🕮 Varda (II).b. Evening b.II.1. Men 🕮 Ami 🕮 Rami b.II.2. Women 🕮 Alona 🕮 sharon	game style no. (1) light athletics I. morning (1) men a.1. ronen b.1. shalom (2) women a.2. ruchama b.2. shani II.evening (1) men a.1. avi b.1. yossi game style no. (2) 100 meter run I. Morning (1) Men a.1. Amit b.1. Eran (2) Women a.2. Revital b.2. Varda II.Evening (1) Men a.1. Ami b.1. Rami (2) Women a.2. Alona	1. Highlight the formatted list 2. Click the multilist drop-down arrow to choose a different multilevel list styles 3. Choose ' define new multilevel list' 4. Select 1 in the ' click level to modify list' 5. Choose number style for this level (1,2,3….) 6. Enter formatting for number (game style no. ()) 7. Select 2 in the ' click level to modify list' 8. leave number style for this level as is (I,II,III….) 9. Add a dot (.) to

Original List provided to students	**Output list- expected to be done by student**	**Element interactivity-list of actions taken by the student to get to the output list**
	b.2. sharon	the number format and erase (()) 10. Erase number and format from level 1 at the formatting window. 11. Select 3 in the ' click level to modify list' 12. Choose number style for this level (1,2,3….) 13. Enter formatting for number (()) 14. Erase number and format from level 1 and level 2 at the formatting window. 15. Select 4 in the ' click level to modify list' 16. Choose number style for

Original List provided to students	**Output list- expected to be done by student**	**Element interactivity-list of actions taken by the student to get to the output list**
		this level (a,b,c…..) 17. Add a dot (.) to the number format 18. Press the drop-down arrow of ' include level number from' and choose ' level 3'

Save this part with your formatted lists, fill the questionnaire (Appendix J)

Appendix G - Designing an interactive presentation- a task related to MS PowerPoint™

Part 1 (The recall part of the experiment)

A. Please answer the following questions:

- A dynamic presentation is also called__________
- In order to create hyperlinks in a slide show one has to press the ________tab and then the______________button
- In order to add an action to an action button one has to press the ____button and the _______ button.

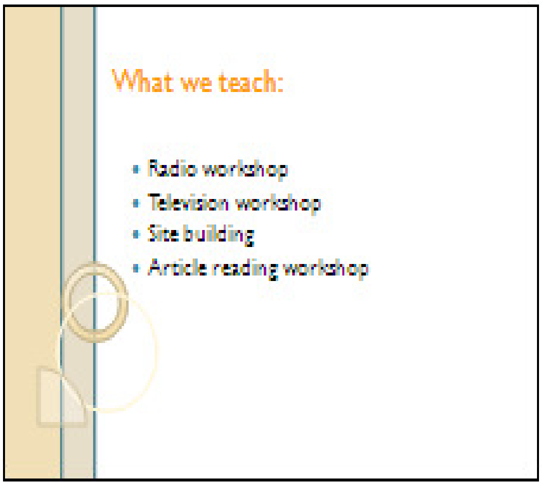
B. (Students opened templates with ready unformatted slide show). Please note: before you start formatting your slide show save the ready template under your id number.

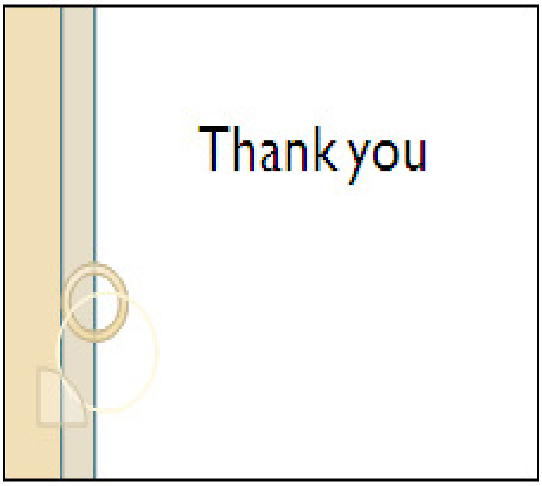
You have a slide show as shown on the video demonstration. Make this slide show a dynamic one by adding hyperlinks and/or actions where needed. Please read the following requirements:

1. On slide #2 make it possible to get to all the workshops on the list by pressing the workshop name.
2. Make it possible to return from each of the workshops (slides #3 and #4)back to slide #2. By adding the text ' back to workshop list'.
3. On slide #2 the text ' site building' will be linked to www.2all.co.il.
4. On slide #2 the text ' article reading' will be linked to article_demo.pdf which can be found in ' class exercises' folder.
5. Make it possible to get from slide #2 to slide #5 by pressing the text ' why is it worth enrolling'.

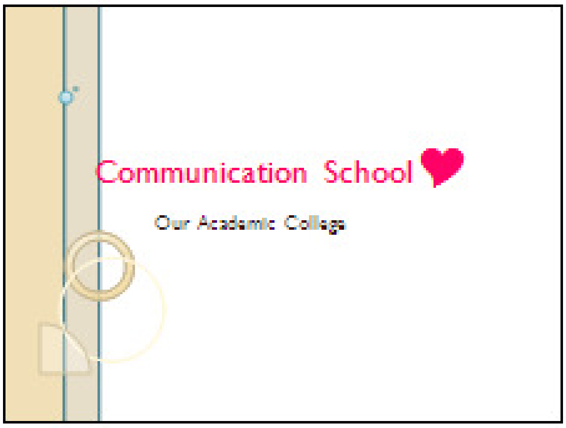
On the next page you can find a description of how your part 1 presentation should look.

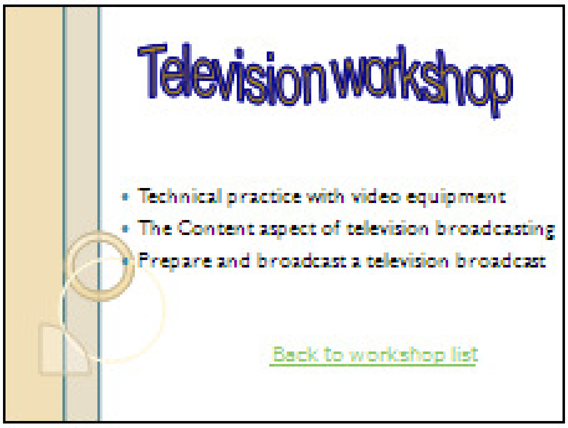
Presentation as appears on template:

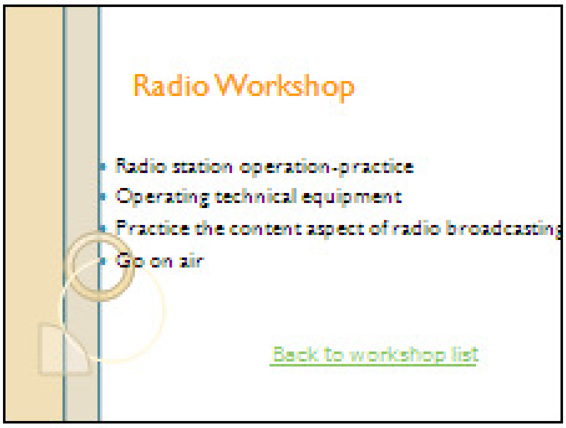




Output presentation:







Save this part with your dynamic slide show, fill the following questionnaire (Appendix J) and continue to part 2.

Element interactivity -Actions students should take by going from template presentation to the final presentation:

1. Select slide # 2
2. Highlight the text ' Radio workshop'
3. Choose the insert tab
4. Go to links commands group
5. Press the ' hyperlink' button
6. Select ' place in this document' in the ' link to:' list
7. Select slide # 3 on the ' select a place in this document' list
8. Press the ' ok' button
9. Highlight the text ' Television workshop'
10. Go to links commands group
11. Press the ' hyperlink' button
12. Select ' place in this document' in the ' link to:' list
13. Select slide # 4 on the ' select a place in this document' list
14. Press the ' ok' button
15. Highlight the text ' Site building'
16. Go to links commands group
17. Press the ' hyperlink' button
18. Select ' Existing File or Web Page' in the ' link to:' list
19. Type www.2all.co.il in the Address window
20. Press the ' ok' button
21. Highlight the text ' Article reading workshop'
22. Press the ' hyperlink' button
23. Select ' Existing File or Web Page' in the ' link to:' list
24. Browse in the ' look in:' window to find the article_demo file
25. Press the ' ok' button
26. Choose slide # 2
27. Create a text box or word art with the text: ' Why is it worth enrolling'
28. Highlight that text
29. Choose the insert tab
30. Go to links commands group
31. Press the ' hyperlink' button
32. Select ' place in this document' in the ' link to:' list
33. Select slide # 5 on the ' select a place in this document' list
34. Press the ' ok' button

Part 2 (This is the transfer part of the experiment)

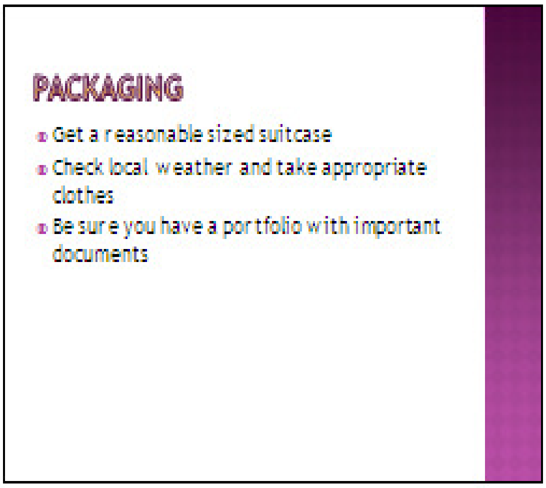
Open part 2 presentation template. The presentation includes instructions for those going on a vacation out of the country. The presentation includes 4 slides. Slide #1- contains the title. Slide #2 packaging instructions. Slide #3 insurance instructions. Slide #4 a list of forms required for insurance purpose.

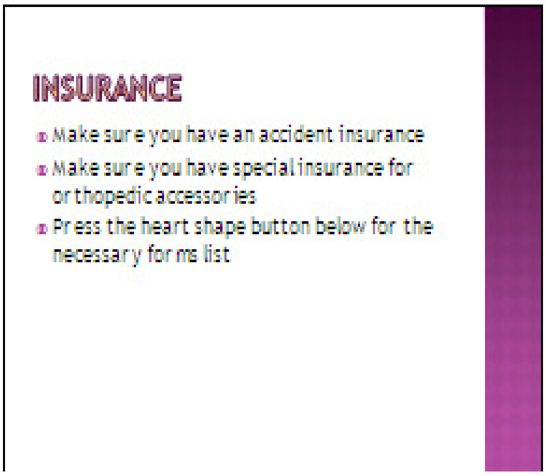
Make it a dynamic presentation following the instructions:

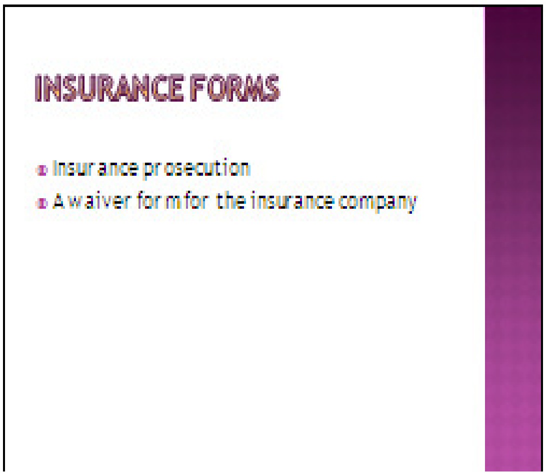
1. On slide #1 add two action buttons: one will lead to the ' packaging' slide and the other will lead to the ' insurance' slide. On the action buttons add a text that will clarify where each of them lead to.
2. On ' packaging' slide add a WordArt object with the text' weather' that will be linked to www.weather.com
3. On ' insurance' slide create a heart shape and link it to slide #4 where the insurance forms list is located.
4. On slide #4 (' insurance forms list') link each form title to the appropriate PDF file which are found in the ' class exercises' folder.
5. Create action button:' home' that will allow returning from each slide on the presentation to the first one and on each slide create the action buttons next and previous as necessary.

On the next page, you can find a description of how your part 2 presentation should look.

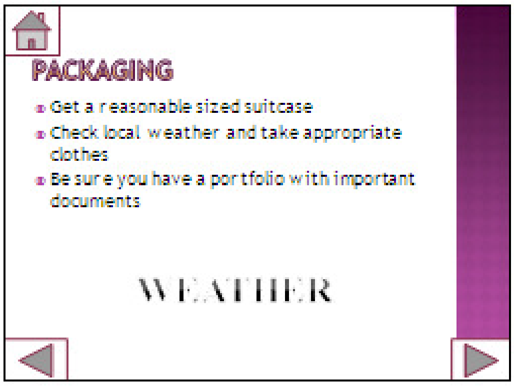
Presentation as appears on template

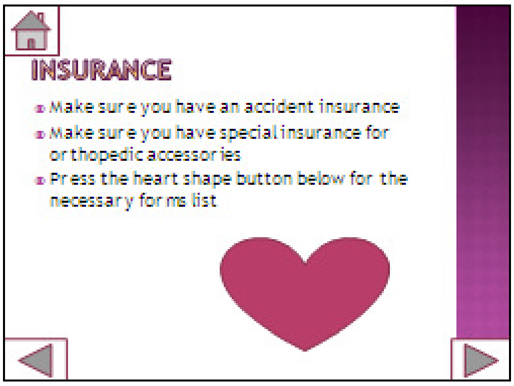


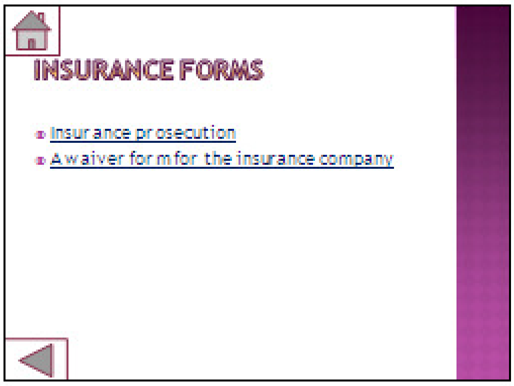




The output presentation:







Element interactivity:

1. Choose slide # 1
2. Choose the insert tab
3. Go to links commands group
4. Press the drop-down shapes button
5. Roll down to action buttons area
6. Choose action button: custom
7. Draw action button
8. On action settings window that opens automatically select radio button ' hyperlink to:
9. Press the scroll-down arrow and choose slide….
10. Choose slide #2 (' Packaging') from Slide Title list

11. Press ok on the hyperlink to slide screen
12. Press ok on the action settings screen
13. Choose the insert tab
14. Go to illustrations commands group
15. Press the drop-down shapes button
16. Roll down to action buttons area
17. Choose action button: custom
18. Draw action button
19. On action settings window that opens automatically select radio button ' hyperlink to:
20. Press the scroll-down arrow and choose slide….
21. Choose slide #3(' Insurance') from Slide Title list
22. Press ok on the hyperlink to slide screen
23. Press ok on the action settings screen
24. Choose slide # 2 (' packaging')
25. Choose the insert tab
26. Go to text commands group
27. Press the scroll-down WordArt button
28. Select one WordArt style
29. Type ' weather' in the text box
30. Choose insert tab
31. Go to links commands group
32. Press hyperlink button
33. Choose Existing File or Web Page on the ' link to:' list
34. Type www.weather.com in the Address window
35. Press ok
36. Choose slide # 3 (' Insurance')
37. Choose the insert tab
38. Go to Illustrations commands group
39. Press the shapes drop-down arrow
40. Identify the heart shape in the basic shapes area
41. Choose the heart shape
42. Draw the heart shape on slide area
43. Choose the insert tab

44. Go to links commands group area
45. Press hyperlink
46. Choose Place in This Document from ' link to:' list
47. Choose slide # 4 from ' Select a Place in this document:' list
48. Press ok
49. Choose slide # 4
50. Highlight the text ' Insurance prosecution '
51. Choose insert tab
52. Go to links commands area
53. Press hyperlink
54. Choose Existing File or Web Page from :link to:' list
55. Browse for the proper PDF file in the ' look in' window
56. Press ok
57. Highlight the text ' A waiver form for the insurance company'
58. Choose insert tab
59. Go to links commands area
60. Press hyperlink
61. Choose Existing File or Web Page from :link to:' list
62. Browse for the Proper PDF file in the ' look in' window
63. Press ok
64. Choose insert tab
65. Press the shapes drop-down arrow in the Illustrations command group area
66. Scroll down to action buttons area
67. Select action button: Home
68. Draw action button: Home on slide # 2
69. Press ok on action settings screen
70. Copy action button: Home to slides #3 and #4
71. Choose insert tab
72. Press the shapes drop-down arrow in the Illustrations command group area
73. Scroll down to action buttons area
74. Select action button: Next
75. Draw action button: Next on slide # 1
76. Press ok on action settings screen
77. Copy action button: Next to slides #2 and #3

78. Choose insert tab
79. Press the shapes drop-down arrow in the Illustrations command group area
80. Scroll down to action buttons area
81. Select action button: Previous
82. Draw action button: Next on slide # 2
83. Press ok on action settings screen
84. Copy action button: Next to slides #3 and #4

Save this part with your dynamic slide show and fill the following questionnaire (Appendix J).

Appendix H -Subtotals and charts- a task related to MS Excel™

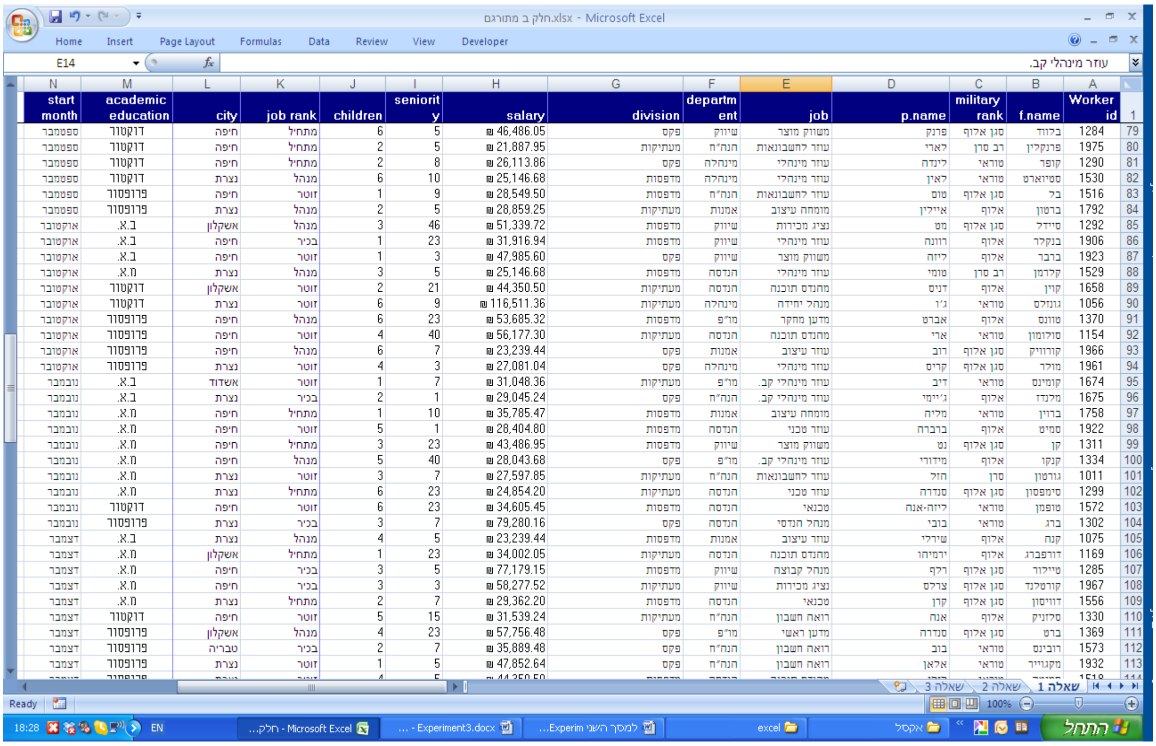
Part 1 (the recall part of the experiment)

Id no.________________

D. Please answer the following questions:
   - The Subtotal command is used for___________________
   - What do you need to do before executing subtotal_________________
   - Choose the correct answer: for each subtotal you can select:
     1. As many functions as you like
     2. Only one function
     3. Up to three functions

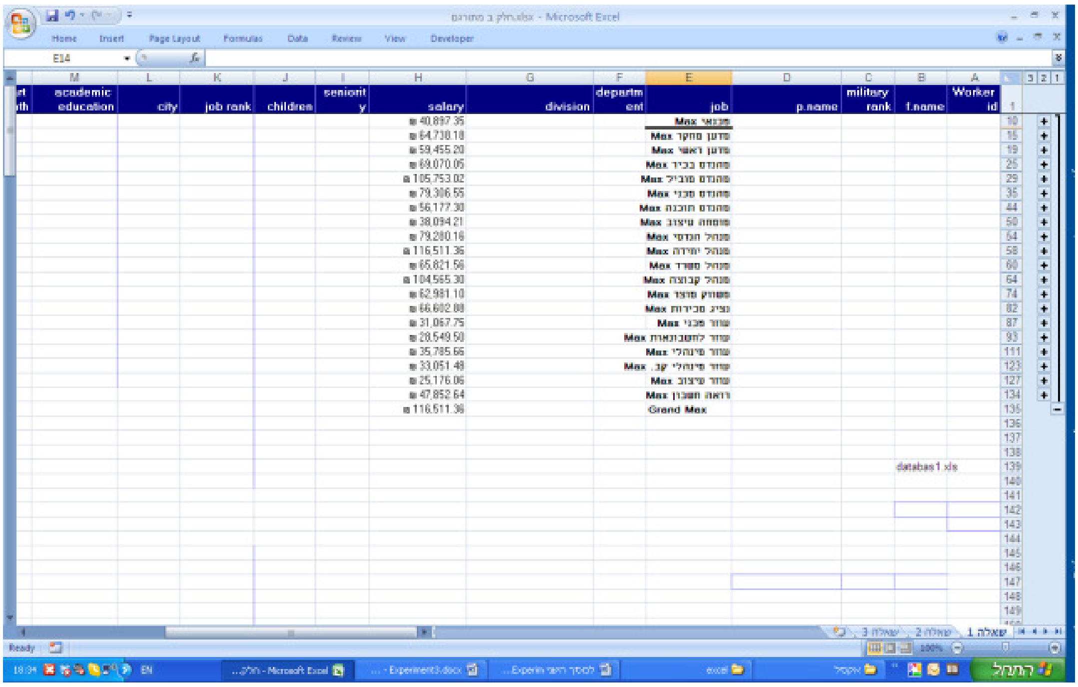
E. Open the excel template ' Part1.xlsx'. There are three sheets in the file. Each sheet includes the same table you have watched in the video demonstration. Please do the following using the subtotal command :
   1. In sheet 1 calculate the highest salary for each group of workers grouped by jobs
   2. In sheet 2 calculate the average years of seniority , the average salary and the average number of children workers have in each department
   3. In sheet 3 insert a bar chart that will allow to compare the number of children each of the workers have and the number of seniority years. The vertical axis will have two headlines; no. of children and seniority. The horizontal axis will show the numbers.

Table included in template;



	Worker id	f.name	military rank	p.name	job	departm ent	division	salary	seniorit y	children	job rank	city	academic education	start month
79	1284	בלווד	סגן אלוף	פרנק	משווק מוצר	שיווק	פקס	₪ 46,486.05	5	6	מתחיל	חיפה	דוקטור	ספטמבר
80	1975	פרנקלין	רב סרן	לארי	עוזר לחשבונאות	הנה"ח	מעתיקות	₪ 21,887.95	5	2	מתחיל	חיפה	דוקטור	ספטמבר
81	1290	קופר	טוראי	לינדה	עוזר מינהלי	מינהלה	פקס	₪ 26,113.86	8	2	מתחיל	חיפה	דוקטור	ספטמבר
82	1530	סטיוארט	טוראי	לאין	עוזר מינהלי	מינהלה	מדפסות	₪ 25,146.68	10	6	מנהל	נצרת	דוקטור	ספטמבר
83	1516	בל	סגן אלוף	טום	עוזר לחשבונאות	הנה"ח	מדפסות	₪ 28,549.50	9	1	זוטר	חיפה	פרופסור	ספטמבר
84	1792	ברטון	אלוף	איילין	מומחה עיצוב	אמנות	מעתיקות	₪ 28,859.25	5	2	מנהל	נצרת	פרופסור	ספטמבר
85	1292	סיידר	סגן אלוף	מט	נציג מכירות	שיווק	מדפסות	₪ 51,339.72	46	3	מנהל	אשקלון	ב.א.	אוקטובר
86	1906	בנקלר	אלוף	רוונה	עוזר מינהלי	שיווק	מדפסות	₪ 31,916.94	23	1	בכיר	חיפה	ב.א.	אוקטובר
87	1923	ברבר	אלוף	ליזה	משווק מוצר	שיווק	פקס	₪ 47,985.60	3	1	זוטר	חיפה	ב.א.	אוקטובר
88	1529	קלרמן	רב סרן	טומי	עוזר מינהלי	הנדסה	מדפסות	₪ 25,146.68	5	3	מנהל	נצרת	מ.א.	אוקטובר
89	1658	קוין	אלוף	דניס	מהנדס תוכנה	הנדסה	מעתיקות	₪ 44,350.50	21	2	זוטר	אשקלון	דוקטור	אוקטובר
90	1056	גונזלס	טוראי	ג'ו	מנהל יחידה	מינהלה	מעתיקות	₪ 116,511.36	9	6	זוטר	נצרת	דוקטור	אוקטובר
91	1370	טוונס	אלוף	אברט	מדען מחקר	מו"פ	מדפסות	₪ 53,685.32	23	6	מנהל	חיפה	פרופסור	אוקטובר
92	1154	סולומון	טוראי	ארי	מהנדס תוכנה	הנדסה	מעתיקות	₪ 56,177.30	40	4	זוטר	חיפה	פרופסור	אוקטובר
93	1966	קורוויק	סגן אלוף	רוב	עוזר עיצוב	אמנות	פקס	₪ 23,239.44	7	6	מנהל	חיפה	פרופסור	אוקטובר
94	1961	מולר	סגן אלוף	קרים	עוזר מינהלי	מינהלה	פקס	₪ 27,081.04	3	4	זוטר	נצרת	פרופסור	אוקטובר
95	1674	קומינס	טוראי	דיב	עוזר מינהלי קב.	מו"פ	מעתיקות	₪ 31,048.36	7	1	זוטר	אשדוד	ב.א.	נובמבר
96	1675	מלנדז	אלוף	ג'יימי	עוזר מינהלי קב.	הנה"ח	פקס	₪ 29,045.24	1	2	בכיר	נצרת	ב.א.	נובמבר
97	1758	ברוין	טוראי	מליה	מומחה עיצוב	אמנות	מדפסות	₪ 35,785.47	10	1	מתחיל	חיפה	מ.א.	נובמבר
98	1922	סמיט	אלוף	ברברה	עוזר טכני	הנדסה	מדפסות	₪ 28,404.80	1	5	זוטר	חיפה	מ.א.	נובמבר
99	1311	קן	סגן אלוף	נט	משווק מוצר	שיווק	מדפסות	₪ 43,486.95	23	3	מתחיל	חיפה	מ.א.	נובמבר
100	1334	קנקו	אלוף	מידורי	עוזר מינהלי קב.	מו"פ	פקס	₪ 28,043.68	40	5	מנהל	חיפה	מ.א.	נובמבר
101	1011	גורטון	סרן	הזל	עוזר לחשבונאות	הנה"ח	מעתיקות	₪ 27,597.85	7	3	זוטר	נצרת	מ.א.	נובמבר
102	1299	סימפסון	סגן אלוף	סנדרה	עוזר טכני	הנדסה	מעתיקות	₪ 24,854.20	23	6	מתחיל	נצרת	מ.א.	נובמבר
103	1572	טופמן	טוראי	ליזה-אנה	טכנאי	הנדסה	מדפסות	₪ 34,605.45	23	6	זוטר	חיפה	דוקטור	נובמבר
104	1302	ברג	טוראי	בובי	מנהל הנדסי	הנדסה	פקס	₪ 79,280.16	7	3	בכיר	נצרת	פרופסור	נובמבר
105	1075	קנה	אלוף	שירלי	עוזר עיצוב	אמנות	מדפסות	₪ 23,239.44	5	4	מנהל	נצרת	ב.א.	דצמבר
106	1169	דורפברג	אלוף	ירמיהו	מהנדס תוכנה	הנדסה	מעתיקות	₪ 34,002.05	23	1	מתחיל	אשקלון	מ.א.	דצמבר
107	1285	טיילור	סגן אלוף	רלף	מנהל קבוצה	שיווק	מדפסות	₪ 77,179.15	5	3	בכיר	חיפה	מ.א.	דצמבר
108	1967	קורטלנד	סגן אלוף	צרלס	נציג מכירות	שיווק	מעתיקות	₪ 58,277.52	3	3	בכיר	חיפה	מ.א.	דצמבר
109	1556	דוויסון	סגן אלוף	קרן	טכנאי	הנדסה	מדפסות	₪ 29,362.20	7	2	מתחיל	נצרת	מ.א.	דצמבר
110	1330	סלזניק	אלוף	אנה	רואה חשבון	הנה"ח	מעתיקות	₪ 31,539.24	15	5	זוטר	חיפה	דוקטור	דצמבר
111	1369	ברט	סגן אלוף	סנדרה	מדען ראשי	מו"פ	פקס	₪ 57,756.48	23	4	מנהל	אשקלון	פרופסור	דצמבר
112	1573	רובינס	טוראי	בוב	רואה חשבון	הנה"ח	פקס	₪ 35,889.48	7	2	בכיר	טבריה	פרופסור	דצמבר
113	1932	מקגווייר	טוראי	אלאן	רואה חשבון	הנה"ח	פקס	₪ 47,852.64	5	1	זוטר	נצרת	פרופסור	דצמבר

Sheet 1- output



	Worker id	f.name	military rank	p.name	job	departm ent	division	salary	seniorit y	children	job rank	city	academic education	start month
10					מכנאי Max			₪ 40,897.35						
15					מדען מחקר Max			₪ 64,738.18						
19					מדען ראשי Max			₪ 59,455.20						
25					מהנדס בכיר Max			₪ 69,070.05						
29					מהנדס מוביל Max			₪ 105,753.02						
35					מהנדס מכני Max			₪ 79,306.55						
44					מהנדס תוכנה Max			₪ 56,177.30						
50					מומחה עיצוב Max			₪ 38,094.21						
54					מנהל הנדסי Max			₪ 79,280.16						
58					מנהל יחידה Max			₪ 116,511.36						
60					מנהל משרד Max			₪ 65,821.56						
64					מנהל קבוצה Max			₪ 104,565.30						
74					משווק מוצר Max			₪ 62,981.10						
82					נציג מכירות Max			₪ 66,602.08						
87					עוזר מכני Max			₪ 31,067.75						
93					עוזר לחשבונאות Max			₪ 28,549.50						
111					עוזר מינהלי Max			₪ 35,785.66						
123					עוזר מינהלי קב. Max			₪ 33,051.48						
127					עוזר עיצוב Max			₪ 25,176.06						
134					רואה חשבון Max			₪ 47,852.64						
135					Grand Max			₪ 116,511.36						
139		databas1.xls												

Element interactivity for q1:

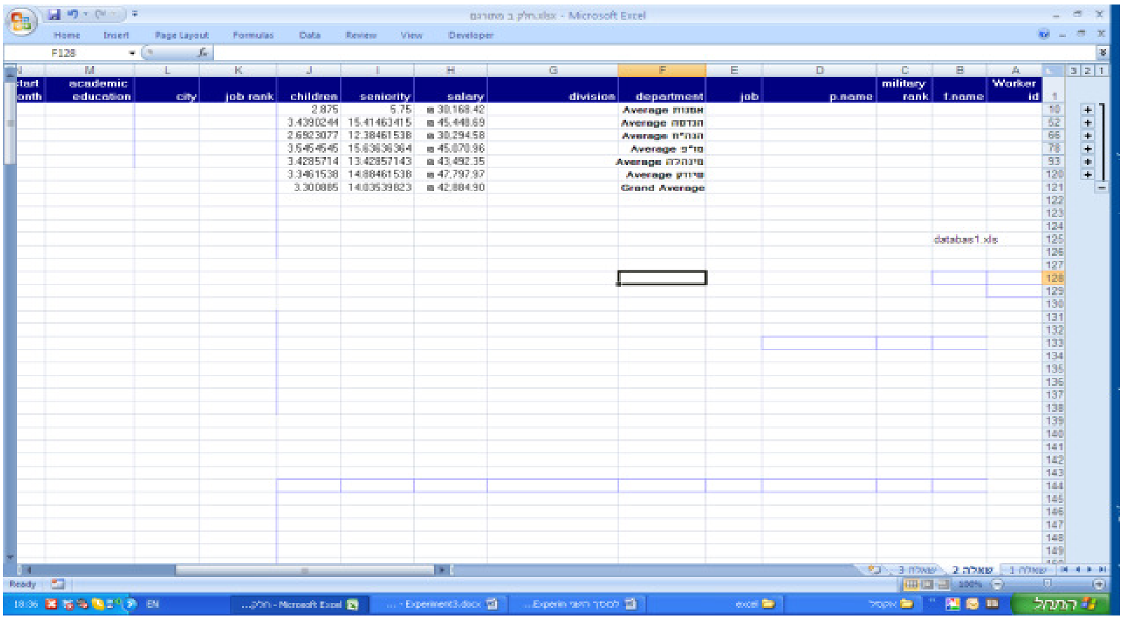
A. Step 1: sort the table by jobs

   1. Place the cursor in one of the table cells
   2. Choose the data tab
   3. Go to sort & Filter commands group
   4. Press the sort button
   5. Make sure the ' My data has headers' checkbox is checked
   6. Press the ' sort by' drop-down arrow
   7. Select ' job'
   8. Order can be A to Z or Z to A
   9. Press ok

B. Step 2: calculate subtotals

   1. Place the cursor in one of the table cells
   2. Choose the data tab
   3. Go to outline commands group
   4. Press the ' subtotal' button
   5. Press the scroll down menu arrow ' At each change in:' and choose ' job'
   6. Press the scroll down menu arrow ' Use function' and choose Max
   7. Check the salary checkbox at the ' Add subtotal to:' window
   8. Press ok
   9. Go to level 2 to see the requested calculations without the data details.

Sheet 2-output

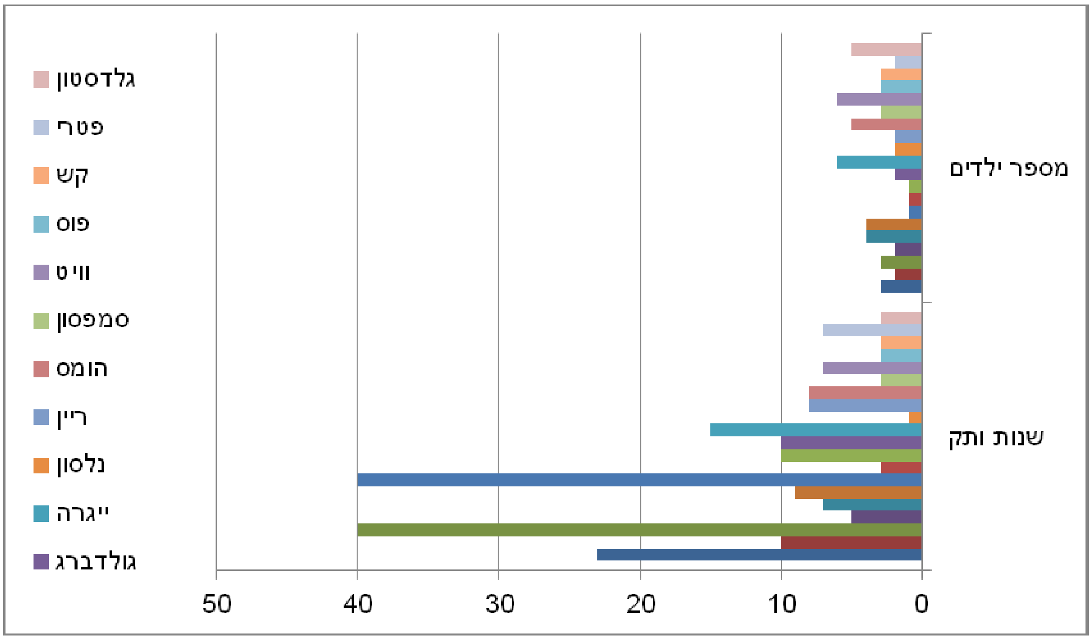


Element interactivity for q2:

A. Step 1: sort the table by department
    1. Place the cursor in one of the table cells
    2. Choose the data tab
    3. Go to sort & Filter commands group
    4. Press the sort button
    5. Make sure the ' My data has headers' checkbox is checked
    6. Press the ' sort by' drop-down arrow
    7. Select ' department'
    8. Order can be A to Z or Z to A
    9. Press ok

B. Step 2: calculate subtotals
    1. Place the cursor in one of the table cells
    2. Choose the data tab
    3. Go to outline commands group
    4. Press the ' subtotal' button
    5. Press the scroll down menu arrow ' At each change in:' and choose ' department'
    6. Press the scroll down menu arrow ' Use function' and choose Average
    7. Check the seniority, salary and children checkbox at the ' Add subtotal to:' window
    8. Press ok
    9. Go to level 2 to see the requested calculations only without the data details.

Sheet 3- output



Element interactivity for q3:

1. Highlight family name column
2. Press CTRL key
3. Highlight no. of children column and seniority column
4. Select insert tab
5. Go to charts command group
6. Press the bar chart drop down arrow
7. Select bar chart
8. If vertical axis does not have two headline: no. of children and seniority switch row/column to get it right

Save this part with your calculations, fill the following questionnaire (Appendix J) and continue to part 2

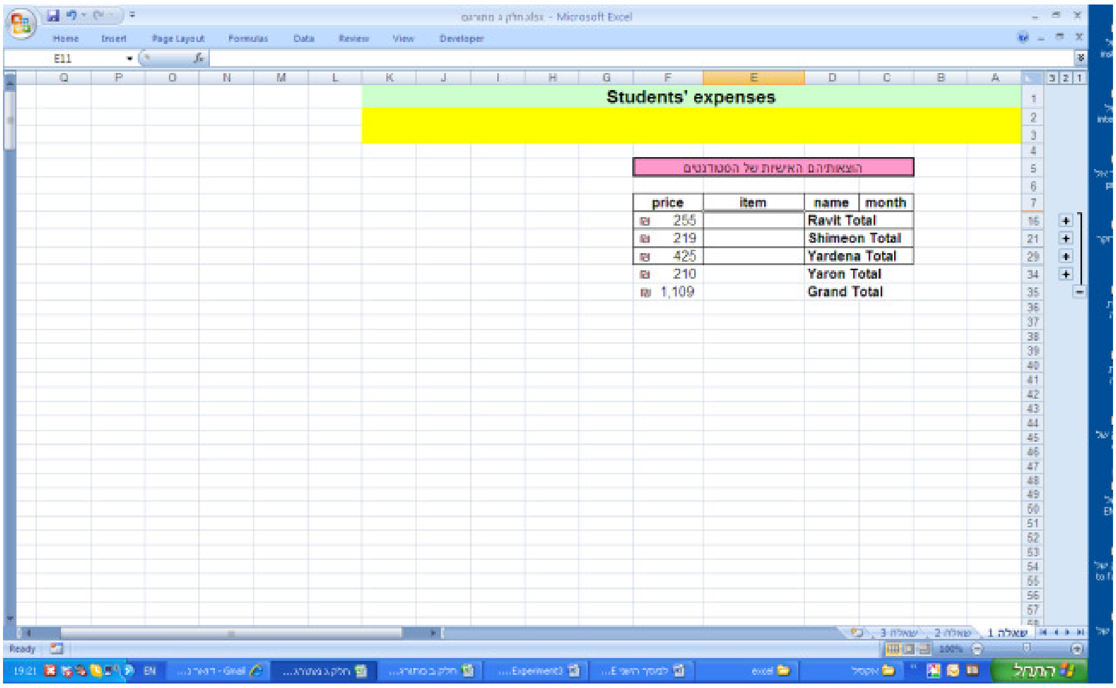
Part 2 (The transfer part of the experience)

A. Open the excel template ' part2.xlsx'. There are three sheets in the file. Each sheet includes a table with data about students' expenses over a period of three months. Please do the following:

1. In sheet 1, calculate the sum of money each of the students spent.
2. In sheet 2, build a column chart that will demonstrate how much money was spent for each of the items. The horizontal axis will show the items names and the vertical axis will show the sum of money.

3. In sheet 3, build a pie chart that will show the percentage of the total students' expenses spent each month.

Sheet 1- output



Element interactivity for q1:

A. Step 1: sort the table by name

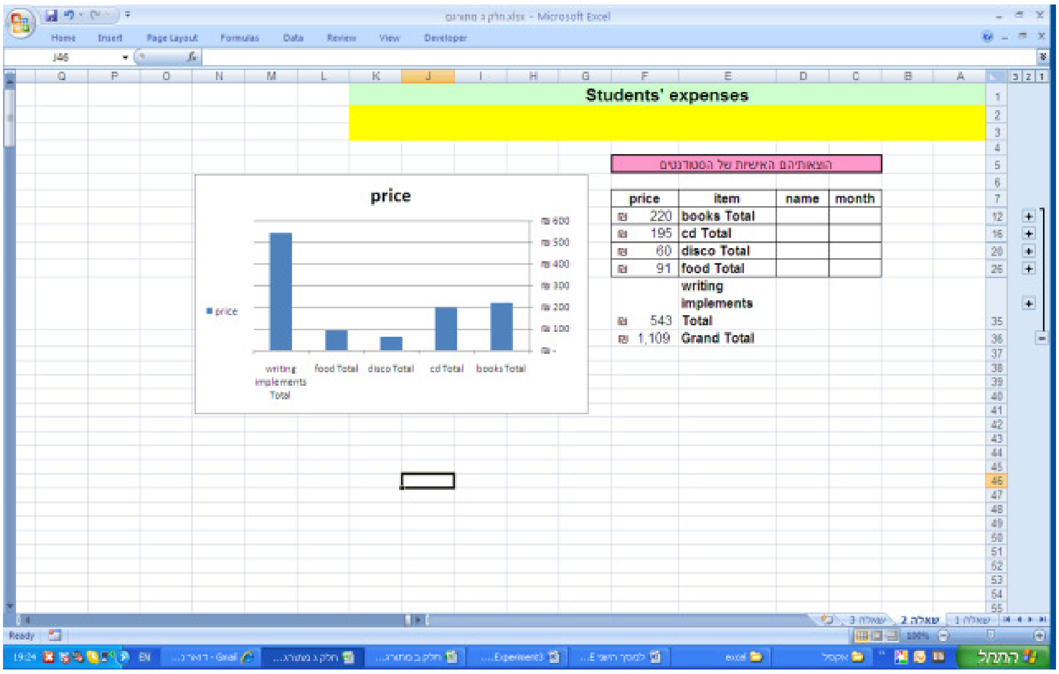
   1. Place the cursor in one of the table cells
   2. Choose the data tab
   3. Go to sort & Filter commands group
   4. Press the sort button
   5. Make sure the ' My data has headers' checkbox is checked
   6. Press the ' sort by' drop-down arrow
   7. Select ' name'
   8. Order can be A to Z or Z to A
   9. Press ok

B. Step 2: calculate subtotals

   1. Place the cursor in one of the table cells
   2. Choose the data tab
   3. Go to outline commands group
   4. Press the ' subtotal' button

5. Press the scroll down menu arrow ' At each change in:' and choose ' name'
6. Press the scroll down menu arrow ' Use function'   and choose Sum
7. Check the price checkbox at the ' Add subtotal to:' window
8. Press ok
9. Go to level 2 to see the requested calculations only without the data details.

Sheet2- output



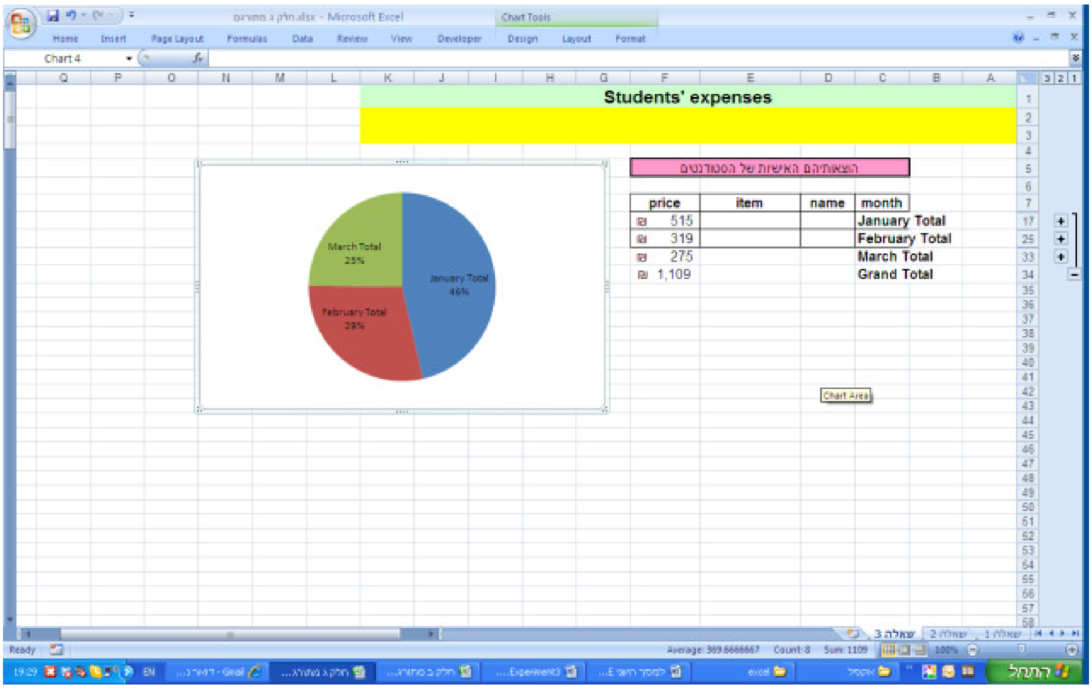
Element interactivity for q2:

A. Step 1: sort the table by item
    1. Place the cursor in one of the table cells
    2. Choose the data tab
    3. Go to sort & Filter commands group
    4. Press the sort button
    5. Make sure the ' My data has headers' checkbox is checked
    6. Press the ' sort by' drop-down arrow
    7. Select ' item'
    8. Order can be A to Z or Z to A
    9. Press ok
B. Step 2: calculate subtotals
    1. Place the cursor in one of the table cells
    2. Choose the data tab

3. Go to outline commands group
4. Press the ' subtotal' button
5. Press the scroll down menu arrow ' At each change in:' and choose ' item'
6. Press the scroll down menu arrow ' Use function'   and choose Sum
7. Check the price checkbox at the ' Add subtotal to:' window
8. Press ok
9. Go to level 2 to see the requested calculations only without the data details.

C. Step 3: create the requested chart
   1. Highlight both the item and price columns
   2. Select the insert tab
   3. Go to the charts commands group and Press the drop down arrow of the column button
   4. Choose clustered columns

Sheet 3- output



Element interactivity for q3:

A. Step 1: sort the table by month
   1. Place the cursor in one of the table cells
   2. Choose the data tab
   3. Go to sort & Filter commands group

4. Press the sort button
5. Make sure the ' My data has headers' check box is marked
6. Press the ' sort by' drop-down arrow
7. Select ' month'
8. Order can be A to Z or Z to A (sorting by custom list was not taught in the NVSC)
9. Press ok

B. Step 2: calculate subtotals
1. Place the cursor in one of the table cells
2. Choose the data tab
3. Go to outline commands group
4. Press the ' subtotal' button
5. Press the scroll down menu arrow ' At each change in:' and choose ' month'
6. Press the scroll down menu arrow ' Use function' and choose Sum
7. Check the price checkbox at the ' Add subtotal to:' window
8. Press ok
9. Go to level 2 to see the requested calculations only.

C. Step 3: create the requested chart
1. Highlight the item and price columns
2. Select the insert tab
3. Go to the charts commands group and Press the drop down arrow of the column button
4. Choose pie chart

Appendix I - Cognitive Load rating scale-on learning

Paas' (1992) Cognitive Load rating scale

In **<u>studying the preceding subject</u>** I invested

1. Very, very low mental effort
2. Very low mental effort
3. Low mental effort
4. Rather low mental effort
5. Neither low nor high mental effort
6. Rather high mental effort
7. High mental effort
8. Very high mental effort
9. Very, very high mental effort

Appendix I - Hebrew version

סמן את המשפט המתאים ביותר להרגשתך עכשיו:

<u>במהלך לימוד הנושא שבהקלטת הווידאו</u> השקעתי:

1. מאמץ חשיבתי מאד מאד נמוך
2. מאמץ חשיבתי מאד נמוך
3. מאמץ חשיבתי נמוך
4. מאמץ חשיבתי די נמוך
5. מאמץ חשיבתי לא נמוך ולא גבוה
6. מאמץ חשיבתי די גבוה
7. מאמץ חשיבתי גבוה
8. מאמץ חשיבתי מאד גבוה
9. מאמץ חשיבתי מאד מאד גבוה

Appendix J - Cognitive Load rating scale-on task

Paas' (1992) Cognitive Load rating scale

In **working on the preceding task** I invested

1. Very, very low mental effort
2. Very low mental effort
3. Low mental effort
4. Rather low mental effort
5. Neither low nor high mental effort
6. Rather high mental effort
7. High mental effort
8. Very high mental effort
9. Very, very high mental effort

Appendix J -Hebrew version

סמן את המשפט המתאים ביותר להרגשתך עכשיו:

במהלך ביצוע התרגיל השקעתי:

1. מאמץ חשיבתי מאד מאד נמוך
2. מאמץ חשיבתי מאד נמוך
3. מאמץ חשיבתי נמוך
4. מאמץ חשיבתי די נמוך
5. מאמץ חשיבתי לא נמוך ולא גבוה
6. מאמץ חשיבתי די גבוה
7. מאמץ חשיבתי גבוה
8. מאמץ חשיבתי מאד גבוה
9. מאמץ חשיבתי מאד מאד גבוה

Appendix K -Participant information sheet

Dear Student,

As part of my efforts to improve my teaching and use of multimedia learning material, I'm conducting research in order to examine how students perceive the learning materials uploaded to the course website and the effectiveness of this learning material.

During the study and as part of our regular classes, I will ask students to experience a video screen captures, after which they will be asked to complete questionnaires and perform a class exercise.

It might be that some students will not be comfortable with the headset and will feel frustrated. It might also be the case that students will not understand the multimedia instructions for various reasons. To compensate for any possible interruption in learning and difficulties in understanding the subject included in the multimedia learning material, that same subject will be taught and revised in class.

Class exercises will be weighed as 2% of their final course grade. Alterative exercises will be uploaded to the course website for those not willing to take the class exercise, so that they have an equal opportunity to get the same credit points. Exercises and questionnaires will be identified by students' ID numbers.

When the semester is over you will be invited for a voluntary short interview in the College premises, which will be recorded upon permission of the interviewee and a follow-up questionnaire will follow.

All data collected will be used for research purposes only and data analysis will be done in complete confidentiality for all study participants. I will be using the research work as part of my studies for a PhD degree with Anglia Ruskin University

Thank you very much for your co-operation

Yaffa Ben-Dror

Appendix L -Assessment Questionnaire for the NVSC

Please answer all the questions

This is an assessment questionnaire for the purpose of research only. It will not have any influence on your grade.

A. Were you familiar with the subject matter before you viewed the video recording? Yes/No

B. Chose the most accurate statement regarding your prior experience with the computer:

1 Never used;

2 Once a month;

3 Once a week;

4 Almost every day;

5 A few times a day;

C. On a scale of 1 to 6 how would you rate the usefulness of this video to you?_____(1-not all 6- very useful)

D. Following is a list of statements on the video recording. Indicate in each case the extent of your agreement with the statement.

	Disagree to a very great extent	**Disagree to a great extent**	**Disagree to some extent**	**Agree to some extent**	**Agree to a great extent**	**Agree to a very great extent**
1. The explanations in the recording were clear	1	2	3	4	5	6
2. When I heard the recording I felt someone was speaking to me personally	1	2	3	4	5	6
3. The explanations in the recording were given in an interesting manner	1	2	3	4	5	6
4. The subject in the recording was presented in an organised manner	1	2	3	4	5	6
5. It was pleasant listening to the recording	1	2	3	4	5	6

	Disagree to a very great extent	Disagree to a great extent	Disagree to some extent	Agree to some extent	Agree to a great extent	Agree to a very great extent
6. I feel the recording will help me to do the class exercise	1	2	3	4	5	6
7. Learning with the help of video recordings is effective	1	2	3	4	5	6
8. Learning with the help of video recordings is interesting	1	2	3	4	5	6
9. I found it easy to understand the explanations in the recording	1	2	3	4	5	6
10. I would rather learn from written material than from a video recording	1	2	3	4	5	6
11. I would rather receive explanations from the teacher in class than from the video recording	1	2	3	4	5	6
12. I found it difficult to concentrate on the explanations given in the recording	1	2	3	4	5	6
13. I had to listen to the recording more than once to feel that I had really understood the material	1	2	3	4	5	6
14. The explanation in the video recording sounded friendly	1	2	3	4	5	6
15. Listening to the recording was not pleasant	1	2	3	4	5	6
16. The pictures on the screen were shown clearly	1	2	3	4	5	6
17. I would prefer to learn all the subjects in the course this way at home instead of attending lessons	1	2	3	4	5	6

	Disagree to a very great extent	**Disagree to a great extent**	**Disagree to some extent**	**Agree to some extent**	**Agree to a great extent**	**Agree to a very great extent**
18. I would like there to be recordings like this for all the subjects studied in the course and for them to be put on the website as auxiliary material for distant learning	1	2	3	4	5	6
19. The explanations in the recording were presented too rapidly for me	1	2	3	4	5	6
20. The explanations in the recording were presented too slowly for me	1	2	3	4	5	6
21. There should have been more detailed explanations and more examples	1	2	3	4	5	6
22. I found it difficult to get used to this method of learning	1	2	3	4	5	6

Appendix L - Hebrew version

דף משוב על הקלטת הווידאו

המשוב נועד לצרכי הערכת ההקלטה ואין לו השפעה על הציון.

נא לענות על כל השאלות

(A)האם ידעת לבנות רשימות מדורגות אוטומטיות **לפני** הצפיה בהקלטת הווידאו? כן/לא

(B) מה היתה מידת השימוש שלך במחשב לפני תחילת הקורס?

1. לא השתמשתי מעולם
2. פעם בחודש
3. פעם בשבוע
4. כמעט כל יום
5. מספר פעמים ביום

(C)בסולם מ 1-6 כיצד תדרג את מידת התרומה של הקלטת הווידאו לידע שלך בנושא הנלמד: (1- בכלל לא, 6-תועלת רבה) _______________

(D)לפניך מספר משפטים הנוגעים להקלטת הווידאו. ציין לגבי כל אחד מהם את מידת הסכמתך .

	לא מסכים במידה רבה מאד	לא מסכים במידה רבה	לא מסכים במידת מה	מסכים במידת מה	מסכים במידה רבה	מסכים במידה רבה מאד
1. ההסברים בהקלטה היו ברורים	1	2	3	4	5	6
2. בזמן ששמעתי את ההקלטה הרגשתי שמדברים אלי באופן אישי	1	2	3	4	5	6
3. ההסברים בהקלטה ניתנו בצורה מעניינת	1	2	3	4	5	6
4. הנושא הוצג בהקלטה בצורה מסודרת	1	2	3	4	5	6
5. היה לי נעים להקשיב להקלטה	1	2	3	4	5	6
6. אני מרגיש/ה שההקלטה תעזור לי בהכנת תרגיל הכיתה	1	2	3	4	5	6
7. לימוד בעזרת הקלטות ווידאו הוא לימוד יעיל	1	2	3	4	5	6
8. לימוד בעזרת הקלטות ווידאו הוא לימוד מעניין	1	2	3	4	5	6
9. היה לי קל להבין את ההסברים בהקלטה	1	2	3	4	5	6
10. הייתי מעדיף ללמוד מחומר כתוב במקום הקלטת ווידאו	1	2	3	4	5	6

	לא מסכים במידה רבה מאד	לא מסכים במידה רבה	לא מסכים במידת מה	מסכים במידת מה	מסכים במידה רבה	מסכים במידה רבה מאד
11. הייתי מעדיף לשמוע את ההסבר מהמורה בכיתה במקום הקלטת ווידאו	1	2	3	4	5	6
12. היה לי קשה להתרכז בהסברים שניתנו לי בהקלטה	1	2	3	4	5	6
13. הייתי צריך לשמוע את ההקלטה יותר מפעם אחת על מנת להרגיש שממש הבנתי את החומר	1	2	3	4	5	6
14. ההסבר בהקלטת הווידאו נשמע לי ידידותי	1	2	3	4	5	6
15. לא היה לי נעים לשמוע את ההקלטה	1	2	3	4	5	6
16. תמונות המסך הוצגו באופן ברור	1	2	3	4	5	6
17. הייתי מעדיף/ה ללמוד בצורה כזאת את כל הנושאים בקורס זה בבית במקום להגיע לשעורים	1	2	3	4	5	6
18. הייתי רוצה שיהיו הקלטות כאלה לכל הנושאים שנלמדים בקורס ושיועלו כחומר עזר לאתר הלמידה מרחוק	1	2	3	4	5	6
19. ההסברים בהקלטה הוצגו בצורה מהירה מדי בשבילי	1	2	3	4	5	6
20. ההסברים בהקלטה הוצגו בצורה איטית מדי בשבילי	1	2	3	4	5	6
21. היה כדאי שבהקלטה יהיו הסברים יותר מפורטים ויותר דוגמאות	1	2	3	4	5	6
22. היה לי קשה להתרגל לצורה זו של לימוד	1	2	3	4	5	6

Appendix M - Participant consent form

First Name:____________ Family Name:

Title of the project: **Multimedia Learning Material**

Main investigator and contact details: Yaffa Ben-Dror, The Academic College

Tel:

Members of the research team: Yaffa Ben-Dror

1. I agree to take part in the above research. I have read the Participant Information Sheet which is attached to this form. I understand what my role will be in this research and all my questions have been answered to my satisfaction.
2. I understand that I am free to withdraw from the research at any time, for any reason and without prejudice.
3. I understand that alterative exercises will be uploaded to the course website for those not willing to take the class exercise, so that they have an equal opportunity to get the same credit points and bonuses granted to the participants.
4. In case I am interviewed, I give my permission to record the interview.
5. I have been informed that the confidentiality of the information I provide will be safeguarded.
6. I am free to ask any questions at any time before and during the study.
7. I have been provided with a copy of this form and the Participant Information Sheet.

Data Protection: I agree to the University[1] processing personal data which I have supplied. I agree to the processing of such data for any purposes connected with the Research Project as outlined to me

Name of participant:

(print)…………………………Signed………………..….Date………………

Name of witness:

(print)……………………………..Signed………………..….Date………………

[1] 'The University' includes Anglia Ruskin University and its partner colleges

Anglia Ruskin University
Cambridge & Chelmsford

YOU WILL BE GIVEN A COPY OF THIS FORM TO KEEP

If you wish to withdraw from the research, please complete the form below and return to the main investigator named above.

Title of Project: **Multimedia Learning Material**

I WISH TO WITHDRAW FROM THIS STUDY

Signed: ___________________________________ Date: _____________________

Appendix N - NEO-FFI Questionnaire– conscientiousness

	Do not agree at all				Fully agree
	1	2	3	4	5
1. I keep my belongings neat and clean	1	2	3	4	5
2. I'm pretty good about pacing myself so as to get things done on time	1	2	3	4	5
3. I am not a very methodical person (reversed)	1	2	3	4	5
4. I try to perform all the tasks assigned to me conscientiously	1	2	3	4	5
5. I have a clear set of goals and work toward them in an orderly fashion	1	2	3	4	5
6. I waste a lot of time before settling down to work (reversed)	1	2	3	4	5
7. I work hard to accomplish my goals	1	2	3	4	5
8. When I make a commitment, I can always be counted on to follow through	1	2	3	4	5
9. Sometimes I'm not as dependable or reliable as I should be (reversed)	1	2	3	4	5

10. I am a productive person who always gets the job done	1	2	3	4	5
11. I never seem to be able to get organized (reversed)	1	2	3	4	5
12. I strive for excellence in everything I do	1	2	3	4	5

Appendix O -Follow-up Questionnaire

Dear Students,

I would greatly appreciate receiving your opinions, feelings and preferences with regard to the narrative NVSCs that have been part of the computer applications course in the three class exercises.

I would normally be very happy to meet with each one of you personally in order to hear your opinions but since I know some of you are busy, I would be pleased if instead of a personal talk you could spare me a few minutes to answer the questions below.

The aim of the questionnaire, as also the aim of the research is to see whether any importance can be attributed to a familiarity with the lecturer, whose voice is heard in the video screen captures, or whether similar video screen captures can be uploaded to the course website, featuring other lecturers from other colleges, who teach the same subjects, without it adversely affecting learning on the part of the students.

Your opinion is very important to me.

You are not required to write anything – just mark what you feel is the most appropriate answer.

Thank you.

Yaffa Ben-Dror

Your ID number____

Q1. From your point of view, is there any importance to the choice of the narrator in the video screen capture?

1. It is important that it is the voice of the lecturer one knows.
2. It does not matter whose voice it is.

Q2. When the voice in the video screen capture is unfamiliar (<u>you can choose more than one answer</u>):

A1. I have an unpleasant feeling.

A2. I have a pleasant feeling.

A3. I cannot concentrate.

A4. It helps me concentrate.

A5. I have to hear the video screen capture a few times in order to understand the explanations.

A6. I find it easy to understand the explanations.

A7. It may help me do the exercises/examination better.

A8. It may make me do the exercises/examination less well.

A9. I try to imagine how the lecturer looks.

A10. I try to guess the personality of the lecturer.

A11. I have the feeling of interaction with the lecturer even though one does not actually see him.

A12. I feel confident that the material is okay.

A13. I feel that the explanations are being directed at me personally.

A14. It does not matter to me only if the subject is easy.

A15. It does not matter to me in general.

A16. It is preferable because it varies the learning.

Q3. When the voice in the video screen capture is that of a lecturer you know (you can choose more than one answer):

A1. I have an unpleasant feeling.

A2. I have a pleasant feeling.

A3. I cannot concentrate.

A4. It helps me concentrate.

A5. I have to hear the video screen capture a few times in order to understand the explanations.

A6. I find it easy to understand the explanations.

A7. It may help me do the exercises/examination better.

A8. It may make me do the exercises/examination less well.

A9. I have the feeling of interaction with the lecturer even though one does not actually see him.

A10. I feel as though I am in the class with the lecturer standing in front of me.

A11. I imagine the lecturer giving explanations.

A12. I feel confident that the material is okay.

A13. I feel that the explanations are being directed at me personally.

A14. It does not matter to me.

Appendix P - Grading rubric- designing a multilevel list

<u>Recall part (total possible points- 100)</u>

<u>A.</u>

<u>performance</u>	<u>points</u>
Knew the correct number of levels	2
Knew the right button for increase level	2
Knew the right button for decrease level	2
Knew what happens when first item is increased	2
Knew that not all numbering format allow previous level inclusion	1
Specified which numbering format does not allow previous level inclusion	1
Total possible points	**10 pts.**

<u>B</u>

First item of the list	Remembered to leave first item in its present level (level 1) **(8 pts.)**	Increased first item level to level 2 but increased the rest of the items respectively **(4 pts.)**	Increased first item level to level 2 and didn't know how to continue **(0 pts.)**		
Increasing levels for the multilevel list	Increased correctly all four levels **(8 pts.)**	Increased correctly three levels **(6 pts.)**	Increased correctly two levels **(4 pts.)**	Increased correctly one level **(2 pts.)**	Didn't increase **(0 pts.)**
Number style	Knew how to select number style and selected the right style for all levels **(8 pts.)**	Knew how to select number style and selected the right style for three levels **(6 pts.)**	Knew how to select number style and selected the right style for two levels **(4 pts.)**	Knew how to select number style and selected the right style for one level **(2 pts.)**	Didn't know how to select number style **(0 pts.)**

numbering format	Knew how to enter format for numbering and entered the right format for all levels **(8 pts.)**	Knew how to enter format for numbering and entered the right format for three levels **(6 pts.)**	Knew how to enter format for numbering and entered the right format for two levels **(4 pts.)**	Knew how to enter format for numbering and entered the right format for one level **(2 pts.)**	Didn't know how to enter format for the numbering **(0 pts.)**
bullet style for level 4	Knew how to select bullet style and selected the right bullet **(8 pts.)**	Knew how to select bullet style but did not select the right bullet **(4 pts.)**	Didn't know how select bullet style **(0 pts.)**		
Total possible points	40 pts				

C

First item of the list	Remembered to leave first item in its present level (level 1) **(6 pts.)**	Increased first item level to level 2 but increased the rest of the items respectively **(3 pts.)**	Increased first item level to level 2 and didn't know how to continue **(0 pts.)**		
Increasing levels for the multilevel list	Increased correctly all four levels **(7 pts.)**	Increased correctly three levels **(6 pts.)**	Increased correctly two levels **(4 pts.)**	Increased correctly one level **(2 pts.)**	Didn't increase **(0 pts.)**
Number style	Knew how to select number style and selected the right style for all levels **(7 pts.)**	Knew how to select number style and selected the right style for three levels **(6 pts.)**	Knew how to select number style and selected the right style for two levels **(4 pts.)**	Knew how to select number style and selected the right style for one level **(2 pts.)**	Didn't know how to select number style **(0 pts.)**

numbering format	Knew how to enter format for numbering and entered the right format for all levels **(7 pts.)**	Knew how to enter format for numbering and entered the right format for three levels **(6 pts.)**	Knew how to enter format for numbering and entered the right format for two levels **(4 pts.)**	Knew how to enter format for numbering and entered the right format for one level **(2 pts.)**	Didn't know how to enter format for the numbering **(0 pts.)**
bullet style for level 4	Knew how to select bullet style and selected the right bullet **(7 pts.)**	Knew how to select bullet style but did not select the right bullet (4 pts.)	Didn't know how select bullet style **(0 pts.)**		
Inclusion of level number from previous levels	Included level number from previous levels for levels 2,3 **(8 pts.)**	Included level number from previous levels for one level only (2 or 3) **(4 pts.)**	Didn't know **(0 pts.)**		
Inserting separations between level numbers	Inserted separations between level numbers for levels 2,3 **(8 pts.)**	Inserted separations between level numbers for one level only (2 or 3) **(4 pts.)**	Didn't know **(0 pts.)**		
Total possible points	50pts				

Transfer part (total possible points- 100)

A

change number style	Knew how to select number style and selected the right style for all levels **(10 pts.)**	Knew how to select number style and selected the right style for three levels **(7 pts.)**	Knew how to select number style and selected the right style for two levels **(5 pts.)**	Knew how to select number style and selected the right style for one level **(2 pts.)**	Didn't know how to select number style **(0 pts.)**
change format for numbering	Knew how to enter format for numbering and entered the right format for all levels **(10 pts.)**	Knew how to enter format for numbering and entered the right format for three levels **(7 pts.)**	Knew how to enter format for numbering and entered the right format for two levels **(5 pts.)**	Knew how to enter format for numbering and entered the right format for one level **(2 pts.)**	Didn't know how to enter format for the numbering **(0 pts.)**
change bullet style	Knew how to select bullet style and selected the right bullet **(10 pts.)**	Knew how to select bullet style but did not select the right bullet **(5 pts.)**	Didn't know how select bullet style **(0 pts.)**		
exclude numbering from previous levels	Excluded numbering from levels 2 & 3 **(10 pts.)**	Excluded numbering from only one level (2 or 3) **(5 pts.)**	Did not know how to exclude numbering from previous levels **(0 pts.)**		
Total possible points	40pts				

B

change number style	Knew how to select number style and selected the right style for all levels **(9 pts.)**	Knew how to select number style and selected the right style for three levels **(7 pts.)**	Knew how to select number style and selected the right style for two levels **(4 pts.)**	Knew how to select number style and selected the right style for one level **(2 pts.)**	Didn't know how to select number style **(0 pts.)**
change format for numbering	Knew how to enter format for numbering and entered the right format for all levels **(9 pts.)**	Knew how to enter format for numbering and entered the right format for three levels **(7 pts.)**	Knew how to enter format for numbering and entered the right format for two levels **(4 pts.)**	Knew how to enter format for numbering and entered the right format for one level **(2 pts.)**	Didn't know how to enter format for the numbering **(0 pts.)**
add text (' game style') to the numbering format level 1	Added text to the numbering format level 1 **(9 pts.)**	Did not add **(0 pts.)**			
change bullet style to number style level 4	changed bullet style to right number style **(9 pts.)**	changed bullet style to wrong number style **(5 pts.)**	Didn't know **(0 pts.)**		
exclude numbering from previous levels on levels 2 & 3	excluded numbering from previous levels on levels 2 & 3 **(9 pts.)**	excluded numbering from previous levels on one level (2 or 3) **(5 pts.)**	Didn't know **(0 pts.)**		

include numbering from previous level for level 4	included numbering from level 3 for level 4 **(9 pts.)**	included numbering from all previous levels for level 4 **(5 pts.)**	Didn't know **(0 pts.)**		
Inserting separations between level numbers on level 4	Inserted separations between level numbers on level 4 **(6 pts.)**	Didn't know **(0 pts.)**			
Total possible points	60pts				

Appendix Q -Grading rubric- designing an interactive presentation

Recall part (total possible points- 100)

A

performance	points
Knew the other definition of a dynamic presentation	2
Knew the right tab for inserting hyperlinks	2
Knew the right button for inserting hyperlinks	2
Knew the right tab for inserting action buttons	2
Knew where to select action buttons	2
Total possible points	**10 pts.**

B

Insert hyperlinks from existing text on slide no. 2 to slides 3 and 4	Created two links **(18 pts.)**	Created one link **(9 pts.)**	Didn't know **(0 pts.)**		
Creating return link from slides 3 and 4 to slide no. 2	Created two links **(18 pts.)**	Created one link **(9 pts.)**	Didn't know **(0 pts.)**		
Hyperlink to a web site	Created the link correctly **(18 pts.)**	Created the link to a wrong website **(12 pts.)**	Inserted the URL in a wrong window **(4 pts.)**	Didn't know **(0pts.)**	
Link a text to a file	Created the link correctly **(18 pts.)**	Created the link to a wrong file **(12 pts.)**	Created the link directly to the file **(4 pts.)**	Didn't know **(0 pts.)**	

Hyperlink from slide no.2 to slide no.5	Created the link correctly **(18 pts.)**	Created the link to a wrong slide **(9 pts.)**	Didn't know **(0 pts.)**		
Total possible points	90 pts				

Transfer Part (total possible points- 100)

Insert action button: custom	Created two action buttons with captions **(17 pts.)**	Created two action buttons without captions **(12 pts.)**	Created one action buttons with caption **(8 pts.)**	Created one action buttons without caption **(4 pts.)**	Didn't know **(0 pts.)**
WordArt	Created WordArt and linked it to the weather site **(16 pts.)**	Created plain text box and linked it to the weather site **(12 pts.)**	Created WordArt and inserted the Url in a wrong window **(8 pts.)**	Created plain text and inserted the URL in a wrong window **(4 pts.)**	Didn't know **(0 pts.)**
Insert an heart shape	Created an heart shape and linked it to the right slide **(17 pts.)**	Created another shape and linked it to the right slide **(12 pts.)**	Created an heart shape and linked it to the wrong slide **(8 pts.)**	Created another shape and linked it to the wrong slide **(4 pts.)**	Didn't know **(0 pts.)**

Link to files from slide No. 4	Linked the right text to the right files **(17 pts.)**	Created two links directly to the files **(12 pts.)**	Linked the right text to only one file **(8 pts.)**	Created one link directly to a file **(4 pts.)**	Didn't know **(0 pts.)**
Insert action button: home	Inserted action button: home in the right places **(16 pts.)**	Inserted only one action button: home **(8 pts.)**	Didn't know **(0 pts.)**		
Insert action buttons: next and previous	Inserted action buttons: next and previous in the right places **(17 pts.)**	Inserted action buttons: next and previous in only one slide **(9 pts.)**	Didn't know **(0 pts.)**		
Total possible points	100pts				

Appendix R - Grading rubric- subtotals and charts - Excel

Recall part (total possible points- 100)

A

performance	points
Knew what the subtotal command is used for	4
Knew one has to sort the data before executing the subtotal command	3
Knew one can choose one function only for each subtotal command	3
Total possible points	**10 pts.**

B

In sheet 1 calculate using subtotal the highest salary for each group of workers grouped by jobs	Sorted the data and used the subtotal command right **(30 pts.)**	Sorted the data but didn't choose the right option in the 'each change in:' window **(20 pts.)**	Didn't sort the data but used the subtotal command right **(10 pts.)**	Didn't know **(0 pts.)**	
In sheet 2 calculate using subtotal the average years of seniority , the average salary and the average number of children workers have in each department	Sorted the data and used the subtotal command right for all calculations **(30 pts.)**	Sorted the data and used the subtotal command right for part of the required calculations **(20 pts.)**	Didn't sort the data but used the subtotal command right **(10 pts.)**	Didn't know **(0 pts.)**	

In sheet 3 insert a bar chart that will allow to compare the number of children each of the workers have and the number of seniority years. The vertical axis will have two headlines; no. of children and seniority. The horizontal axis will show the numbers	Created the right bar chart **(30 pts.)**	Created the right bar chart but didn't switch row/column **(22 pts.)**	Created the right bar chart but didn't include headlines on axis **(15 pts.)**	Created the right bar chart, but included only partial data **(7 pts.)**	Didn't know **(0 pts.)**
Total possible points	90 pts				

<u>Transfer Part (total possible points- 100)</u>

In sheet 1 calculate the sum of money each of the students spent	Sorted the data and used the subtotal command right **(20 pts.)**	Sorted the data but didn't choose the right option in the 'each change in:' window **(14 pts.)**	Didn't sort the data but used the subtotal command right **(7 pts.)**	Didn't know **(0 pts.)**	
In sheet 2 prepare data for bar chart by using the subtotal command	Sorted the data and used the subtotal command right **(20 pts.)**	Sorted the data but didn't choose the right option in the 'each change in:' window **(14 pts.)**	Didn't sort the data but used the subtotal command right **(7 pts.)**	Didn't know **(0 pts.)**	

In sheet 2 build a column chart that will demonstrate how much money was spent for each of the items. The horizontal axis will show the items names and the vertical axis will show the sum of money	Created the right bar chart **(20 pts.)**	Created the right bar chart but didn't switch row/column **(15 pts.)**	Created the right bar chart but didn't include headlines on axis **(10 pts.)**	Created the right bar chart, but included only partial data **(5 pts.)**	Didn't know **(0 pts.)**
In sheet 3 prepare data for pie chart by using the subtotal command	Sorted the data and used the subtotal command right **(20 pts.)**	Sorted the data but didn't choose the right option in the 'each change in:' window **(14 pts.)**	Didn't sort the data but used the subtotal command right **(7 pts.)**	Didn't know **(0 pts.)**	
In sheet 3 build a pie chart that will show the percentage of the total students' expenses spent each month	Created the right pie chart **(20 pts.)**	Created the right pie chart but didn't include headlines **(14 pts.)**	Created the right bar chart, but included only partial data **(7 pts.)**	Didn't know **(0 pts.)**	
Total possible points	100pts				

Appendix S - Interview guide

The preliminary questions that were prepared ahead of the interview were:

- What is your opinion of the mode of learning using NVSC?
- Did anything bother you while watching the NVSC?
- Would you be willing to study this way throughout the course?
- Who was the narrator in the recording you heard? Was it your teacher?
- Was it an unfamiliar narrator? Was it a man or a woman?
- For those who heard a familiar voice – What did you feel when you heard a familiar voice?
- For those who heard an unfamiliar voice – What did you feel when you heard an unfamiliar voice?
- In the case of non-identical gender– Did it make any difference to you that the narrator was of the opposite gender?
- In the case of identical gender– Did it make any difference to you that the narrator was of the same gender as yours?
- In the case of a familiar voice – Would it have bothered you if the recording had an unfamiliar voice? For those who answered in the positive – Would it have compensated for this if the voice had belonged to a person of the same gender as yours?

Appendix T -Sample interviews with Students

Interview I-The student heard an unfamiliar male and had no preference for a particular voice.

Interview II-The student heard an unfamiliar male and preferred a familiar voice

Interview with student I

Researcher: Thank you for coming. I will explain to you the purpose of this meeting. The course included a class exercise accompanied by a video tutorial. Do you remember the voice of the narrator in the tutorial you heard?

Student: Yes. It was a man.

Researcher: I would like to know how important it is for you personally that the recordings be mine as against recordings with narration by someone else. Did it bother you the voice was not mine?

Student: Not too much.

Researcher: No?

Student: No. That is, we know your voice because you are our lecturer. This gives us the feeling of being in a lesson. You simply explain it well.

Researcher: Okay, but let's take the recording with the man's voice. Was there a feeling that the explanation was less good? Was your attention distracted because it was not my voice?

Student: Perhaps the intonation was different from yours.

Researcher: Well, it's clear that there was a difference. The question is: did it bother you?

Student: I can say that it was not too bad. It was okay. If I was sitting at home and studying alone with the help of recordings it would not really make a difference. I think it was okay from my point of view – it could be someone else's voice. Although I think that the recording itself, simply, it was as though … I don't know … when <u>you</u> explain it there is a sort of interest. You know, you deliver it with feeling; I'm not sure how to put it.

Researcher: Okay, again it's the intonation. Not the content.

Student: Yes. The content was clear.

Researcher: I'll tell you why I am asking. If you noticed, Office learning material on the course website involves a lot of video recordings and since the versions are constantly changing, I have to each time record everything again and in only the past few years I have made hundreds of recordings, first it was for the 2003 version and then for the 2007 version and soon it will be for 2010. I wonder if it is important that I do this or if I can turn to repositories on the Internet containing material produced by other lecturers because all these programs are being studied elsewhere. Can I access these places and download recordings of other lecturers from there?

Student: I don't see anything against it unless you teach a certain subject in a certain way and another lecturer would teach it in a different way. This could be very confusing, especially for those not really experienced with computers.

Researcher: And if it passes muster from my point of view?

Student: No problem at all. It's only someone else's sound.

Researcher: In other words, from your point of view what is important is the content alone.

Student: Yes.

Researcher: I have a question. If, let's assume, I decide to download material from various repositories on the Internet, there could be a collection of recordings that on my part have passed muster in terms of content, although it belongs to different lecturers. What do you say to that?

Student: Coming to think of it, hearing someone different each time could make me feel a trifle uncomfortable because we would expect to hear your voice and suddenly we hear someone else's, so now it's getting used to someone else. We are also used to your wording and know what you mean. Perhaps someone else will use other wording and we don't know the other person.

Researcher: In other words, you define this as a slight discomfort that can be overcome if you hear it more than once.

Student: Yes.

Researcher: When you heard the recording by the man did you try to imagine what he looked like?

Student: Actually, his voice sounded like someone from our class so I imagined him since they had exactly the same voice.

Researcher: When you hear something do you have a visual image in your mind?

Student: Perhaps a certain kind of character.

Researcher: When you heard my voice on the course web site before the examination did you see me teaching?

Student: No, I saw you recording this.

Researcher: You know you are the second person to say this and this is interesting because you've never seen me doing a recording.

Student: I didn't imagine you sitting at home but at a table in the college, sitting and recording. There is also a background noise, which we hear.

Researcher: Yes, I did not do the recordings in a studio; it is not a professional recording. So I have a question, there are also firms that do this, so it is possible to obtain recordings with professional narration. So assuming a professional narrator, would that be preferable?

Student: It would sound better, no more than that.

Researcher: If you had to choose between my voice and the voice of a professional narrator?

Student: Makes no difference. Because we need the recordings only to see what you mean and what you are driving at in the classroom. It gives us an indication: 'she does it this way and if we do it the same way we'll get high marks '. If you say that the material has passed your critical eye it doesn't matter whose voice it is.

Researcher: Did the man's non-professional voice bother you?

Student: It didn't bother me, only what was said was important.

Researcher: Would it make a difference if it was a man or a woman?

Student: No.

Researcher: Let's say that when I enter such a repository of recordings it would be better for me to know the students' preferences. Perhaps a lecturer could make things difficult for his students by giving them my recordings? Perhaps it would bother the students if it was not the voice of their lecturer? That is why I ask – I don't want to make things difficult for my students with someone else's recordings and I don't want other lecturers to make things difficult for their students with my recordings.

Student: I think it's great that you want to know. I think that home assignments should be given that are based on the recordings.

Researcher: You mean, study everything on your own?

Student: No, give the students exercises with various recordings not with your voice and then you will have an indication, you can ask them, because with us you did it only once. I don't think it's so terrible, in the final analysis it's only the quality that matters.

Researcher: Yes, assuming that it is the same quality and a good one.

Student: So it makes no difference. Only that it should be clear. It's as though I were watching an instruction on YouTube. What difference does it make who speaks?

Researcher: Okay. That's your opinion. Every student has a different opinion. There was someone here who claimed that I simply have no choice and that I have to do this because it is something psychological.

Student: Okay, for me it makes no difference. We will be certain about it if you tell us that the material is accurate and that that is what we need to know for the exam.

Researcher: Do you have anything more to add?

Student: No, the course was a nice one. I don't know if we will use everything we learned but it was nice. And another thing, if there is someone else's voice each time, I don't know, but if there is a series of recordings by the same person one could get used to it. If there is a different voice each time it would be strange. With someone else each time it would be as though you'd let each of us do a recording on a different subject and then let another class hear it. That's strange. It's like a radio program that you are used to hearing with the same moderator. You expect to hear the same person.

Researcher: It's important for me to know because there are so many repositories now.

Student: I am for it; it should be possible to download material from repositories but not to get carried away. There should be consistency and the recordings should be by the same person.

Researcher: Okay. Thank you very much. If you have anything more to add I would be glad to receive an email about it from you.

Interview with Student - II

Researcher: I want to explain the purpose of this meeting. In the framework of the class exercise one of the subjects you learned was through a video recording. Do you remember the narrator in the recording you heard?

Student: Yes, it was a man.

Researcher: Did it bother you to hear a recording that did not have a familiar voice?

Student: In a sense, yes.

Researcher: In what sense?

Student: It's simply a question of habit. You are used to a certain person and suddenly you have him changed. For example, when I heard the man I lost concentration and so I feel that it affected the grade I got on the exercise.

Researcher: Do you think you found the exercise difficult because of the voice?

Student: Yes, I do think so.

Researcher: And if you had heard it twice or three times, would that not have improved your concentration?

Student: Yes. That would have helped, but when you hear it only once or one and a half times sort of, it bothers you. When you hear someone unfamiliar you attach less importance to it.

Researcher: What you are saying is very interesting. You attached less importance to the recording even though it was I who had given it to you?

Student: Yes. It was not my teacher.

Researcher: Interesting. This is of interest to me because if it is so important for the narration in the recording to be mine, it means that from my point of view I have to make all these recordings over and over again as the versions of the software change. Today there are all sorts of repositories for learning materials that lecturers share among themselves and in fact I can upload even my recordings to such a repository for other lecturers to use. In light of what you said the question is what will happen if now, with the new version, instead of recording new learning material for it I accessed a repository with recordings of other lecturers and assuming that they are good and pass muster as far as I am concerned, they are not my recordings but someone else's and I upload them to the site, will this in your opinion be less good from the student's point of view?

Student: I think you will need to prepare a small introduction before use of the recordings saying that they are not yours in order for the students to be sure that it's okay and to prevent what happened to me – that when I heard it was not you I treated it less seriously. It's a question of habit.

Researcher: If I gave my recordings to lecturers in another college would that be less beneficial for their students as it might be for you?

Student: It's individual. With me it made a difference.

Researcher: When you hear a recording do you just hear a voice and that's it? Or do you imagine in your mind how the person looks?

Student: No. I don't imagine anything.

Researcher: One can tell an age range from the voice. For example, how old was the man you heard?

Student: Forty plus.

Researcher: When you heard my voice in the recordings I uploaded to the course site ahead of the exam, did you imagine seeing me in the classroom?

Student: Yes, because I know you so I had a feeling that you were speaking to me since the voice was familiar.

Researcher: And when the voice was different you say you didn't see in your mind the unfamiliar narrator and that this spoiled your concentration?

Student: Yes.

Researcher: Let's assume that for lack of a choice use will be made of recordings with a voice that is unfamiliar to you. Is it important that the voice be that of a woman or a man?

Student: Perhaps partially. A woman's voice, at least for a man, is more soothing.

Researcher: Really?

Student: Yes. Perhaps it's because I am a man. But in fact with GPS it's preferable that it be a man.

Researcher: Why? Because he is giving instructions?

Student: No, because the road is meant for men …

Researcher: I have a hypothetical question: Supposing I compromise and download recordings of other lecturers from Internet repositories and I go over everything and select the good ones so that I have a collection of recordings with different voices. Could there be any harm if, let's say, there would be 10 different voices?

Student: I think so. It's the same thing. By the time you get used to a certain voice, you have it changed. It takes you a few minutes to get used to it.

Researcher: I hear different opinions and that is why I am interviewing students. For some it makes a big difference and for some it does not.

Student: I think it's related to a kind of learning disability.

Researcher: You think it's related to problems of attention and concentration?

Student: Yes, I have problems of attention and concentration and therefore it bothers me and I think that a normal person should not be bothered by it. With me it's enough that the sound is different, the voice is different; this already spoils my concentration.

Researcher: If, for example, these recordings were professional ones – let's suppose I purchased them from a professional firm that employs a professional narrator, would that be better? Because I am not professional, my voice is not radiophonic.

Student: Right, but once I am used to a lecturer. I prefer someone professional in the field of study and it's preferable that it be the lecturer. An unfamiliar voice is in any event a disadvantage.

Researcher: In other words, what you are saying is that if I want the good of my students it's better that I do the recordings myself. You advise me to do all the recordings over, even though there are other alternatives.

Student: Yes, it's important but naturally you must take into consideration the effort. It's your business. Personally, I would prefer it to be your voice.

Researcher: Okay. So I have obtained an idea of your preferences. Is there anything else you would like to add?

Student: No, I think I've said everything.

Researcher: Okay. Thank you for coming and explaining your position to me. It was very important for me to hear you. If you wish to add something you can send me an email whenever you want.

Appendix U - SPSS output of the MANCOVA tests

General Linear Model

Between-Subjects Factors

		Value Label	N
voice_familiarity	1.00	Familiar voice	173
	2.00	Unfamiliar voice	200
voice_similarity	1.00	Same gender as student	194
	2.00	Different gender than student	179

Descriptive Statistics

	voice_familiarity	voice_similarity	Mean	Std. Deviation	N
Learning_process_efficiency_REC	Familiar voice	Same gender as studer	.2887	1.17370	100
		Different gender than student	.3063	1.19311	73
		Total	.2961	1.17850	173
	Unfamiliar voice	Same gender as studer	.0322	1.30261	94
		Different gender than student	-.5169	1.17207	106
		Total	-.2588	1.26226	200
	Total	Same gender as studer	.1644	1.24128	194
		Different gender than student	-.1812	1.24528	179
		Total	-.0014	1.25351	373
Learning_process_efficiency_TRN	Familiar voice	Same gender as studer	.3148	1.06813	100
		Different gender than student	.3109	1.13951	73
		Total	.3131	1.09555	173
	Unfamiliar voice	Same gender as studer	.0034	1.33487	94
		Different gender than student	-.5192	1.14038	106
		Total	-.2736	1.25987	200
	Total	Same gender as studer	.1639	1.21169	194
		Different gender than student	-.1806	1.20819	179
		Total	-.0014	1.22061	373

Box's Test of Equality of Covariance Matrices [a]

Box's M	36.325
F	3.996
df1	9
df2	1137341
Sig.	.000

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientiousness+Ztest_anxiety+voice_familiarity * voice_similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Multivariate Tests[c]

Effect		Value	F	ypothesis (	Error df	Sig.	Partial Eta Squared	Noncent. Paramete	Observed Power[a]
Intercept	Pillai's Trace	.010	1.894[b]	2.000	62.000	.152	.010	3.787	.393
	Wilks' Lambd	.990	1.894[b]	2.000	62.000	.152	.010	3.787	.393
	Hotelling's Tr	.010	1.894[b]	2.000	62.000	.152	.010	3.787	.393
	Roy's Larges	.010	1.894[b]	2.000	62.000	.152	.010	3.787	.393
voice_familiarit	Pillai's Trace	.055	10.463[b]	2.000	62.000	.000	.055	20.926	.988
	Wilks' Lambd	.945	10.463[b]	2.000	62.000	.000	.055	20.926	.988
	Hotelling's Tr	.058	10.463[b]	2.000	62.000	.000	.055	20.926	.988
	Roy's Larges	.058	10.463[b]	2.000	62.000	.000	.055	20.926	.988
voice_similarity	Pillai's Trace	.010	1.890[b]	2.000	62.000	.153	.010	3.780	.392
	Wilks' Lambd	.990	1.890[b]	2.000	62.000	.153	.010	3.780	.392
	Hotelling's Tr	.010	1.890[b]	2.000	62.000	.153	.010	3.780	.392
	Roy's Larges	.010	1.890[b]	2.000	62.000	.153	.010	3.780	.392
sex	Pillai's Trace	.009	1.636[b]	2.000	62.000	.196	.009	3.272	.345
	Wilks' Lambd	.991	1.636[b]	2.000	62.000	.196	.009	3.272	.345
	Hotelling's Tr	.009	1.636[b]	2.000	62.000	.196	.009	3.272	.345
	Roy's Larges	.009	1.636[b]	2.000	62.000	.196	.009	3.272	.345
computer_expe	Pillai's Trace	.010	1.811[b]	2.000	62.000	.165	.010	3.622	.378
	Wilks' Lambd	.990	1.811[b]	2.000	62.000	.165	.010	3.622	.378
	Hotelling's Tr	.010	1.811[b]	2.000	62.000	.165	.010	3.622	.378
	Roy's Larges	.010	1.811[b]	2.000	62.000	.165	.010	3.622	.378
Zconscientious	Pillai's Trace	.003	.610[b]	2.000	62.000	.544	.003	1.221	.152
	Wilks' Lambd	.997	.610[b]	2.000	62.000	.544	.003	1.221	.152
	Hotelling's Tr	.003	.610[b]	2.000	62.000	.544	.003	1.221	.152
	Roy's Larges	.003	.610[b]	2.000	62.000	.544	.003	1.221	.152
Ztest_anxiety	Pillai's Trace	.045	8.570[b]	2.000	62.000	.000	.045	17.140	.967
	Wilks' Lambd	.955	8.570[b]	2.000	62.000	.000	.045	17.140	.967
	Hotelling's Tr	.047	8.570[b]	2.000	62.000	.000	.045	17.140	.967
	Roy's Larges	.047	8.570[b]	2.000	62.000	.000	.045	17.140	.967
voice_familiarit voice_similarity	Pillai's Trace	.017	3.131[b]	2.000	62.000	.045	.017	6.263	.600
	Wilks' Lambd	.983	3.131[b]	2.000	62.000	.045	.017	6.263	.600
	Hotelling's Tr	.017	3.131[b]	2.000	62.000	.045	.017	6.263	.600
	Roy's Larges	.017	3.131[b]	2.000	62.000	.045	.017	6.263	.600
voice_familiarit Zconscientious	Pillai's Trace	.012	2.174[b]	2.000	62.000	.115	.012	4.348	.444
	Wilks' Lambd	.988	2.174[b]	2.000	62.000	.115	.012	4.348	.444
	Hotelling's Tr	.012	2.174[b]	2.000	62.000	.115	.012	4.348	.444
	Roy's Larges	.012	2.174[b]	2.000	62.000	.115	.012	4.348	.444
voice_familiarit Ztest_anxiety	Pillai's Trace	.001	.160[b]	2.000	62.000	.852	.001	.320	.075
	Wilks' Lambd	.999	.160[b]	2.000	62.000	.852	.001	.320	.075
	Hotelling's Tr	.001	.160[b]	2.000	62.000	.852	.001	.320	.075
	Roy's Larges	.001	.160[b]	2.000	62.000	.852	.001	.320	.075

a. Computed using alpha = .05

b. Exact statistic

c. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientious similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Learning_process_efficiency_REC	.564	3	369	.639
Learning_process_efficiency_TRN	.400	3	369	.753

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientiousness+Ztest_anxiety+voice_familiarity * voice_similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Tests of Between-Subjects Effects

Source	Dependent Va	ype III Sur of Squares	df	lean Squar	F	Sig.	Partial Eta Squared	Noncent. Parametei	Observed Power[a]
Corrected Mode	Learning_proc efficiency_REC	82.989[b]	9	9.221	6.674	.000	.142	60.066	1.000
	Learning_proc efficiency_TRN	84.540[c]	9	9.393	7.260	.000	.153	65.336	1.000
Intercept	Learning_proc efficiency_REC	4.391	1	4.391	3.178	.075	.009	3.178	.428
	Learning_proc efficiency_TRN	2.376	1	2.376	1.836	.176	.005	1.836	.272
voice_familiarity	Learning_proc efficiency_REC	25.453	1	25.453	18.423	.000	.048	18.423	.990
	Learning_proc efficiency_TRN	27.128	1	27.128	20.965	.000	.055	20.965	.995
voice_similarity	Learning_proc efficiency_REC	4.507	1	4.507	3.262	.072	.009	3.262	.437
	Learning_proc efficiency_TRN	4.904	1	4.904	3.790	.052	.010	3.790	.493
sex	Learning_proc efficiency_REC	.762	1	.762	.552	.458	.002	.552	.115
	Learning_proc efficiency_TRN	.006	1	.006	.004	.948	.000	.004	.050
computer_expe	Learning_proc efficiency_REC	4.934	1	4.934	3.571	.060	.010	3.571	.470
	Learning_proc efficiency_TRN	4.398	1	4.398	3.399	.066	.009	3.399	.452
Zconscientiousr	Learning_proc efficiency_REC	.074	1	.074	.054	.817	.000	.054	.056
	Learning_proc efficiency_TRN	.048	1	.048	.037	.847	.000	.037	.054
Ztest_anxiety	Learning_proc efficiency_REC	21.394	1	21.394	15.485	.000	.041	15.485	.975
	Learning_proc efficiency_TRN	22.142	1	22.142	17.112	.000	.045	17.112	.985
voice_familiarity voice_similarity	Learning_proc efficiency_REC	8.672	1	8.672	6.277	.013	.017	6.277	.705
	Learning_proc efficiency_TRN	7.104	1	7.104	5.490	.020	.015	5.490	.647
voice_familiarity Zconscientiousr	Learning_proc efficiency_REC	5.779	1	5.779	4.183	.042	.011	4.183	.532
	Learning_proc efficiency_TRN	5.453	1	5.453	4.214	.041	.011	4.214	.535
voice_familiarity Ztest_anxiety	Learning_proc efficiency_REC	.424	1	.424	.307	.580	.001	.307	.086
	Learning_proc efficiency_TRN	.403	1	.403	.311	.577	.001	.311	.086
Error	Learning_proc efficiency_REC	501.530	363	1.382					
	Learning_proc efficiency_TRN	469.700	363	1.294					
Total	Learning_proc efficiency_REC	584.520	373						
	Learning_proc efficiency_TRN	554.241	373						
Corrected Total	Learning_proc efficiency_REC	584.519	372						
	Learning_proc efficiency_TRN	554.241	372						

a. Computed using alpha = .05

b. R Squared = .142 (Adjusted R Squared = .121)

c. R Squared = .153 (Adjusted R Squared = .132)

Parameter Estimates

Dependent Vari	Parameter	B	Std. Error	t	Sig.	5% Confidence Interva		Partial Eta Squared	Noncent. Parameter	Observed Power[a]
						ower Bound	pper Bound			
Learning_proce efficiency_REC	Intercept	-1.150	.357	-3.218	.001	-1.853	-.447	.028	3.218	.894
	[voice_familiarity=	.844	.181	4.668	.000	.488	1.199	.057	4.668	.996
	[voice_familiarity=	0[b]	.	.	.	.	.	.	.	.
	[voice_similarity=	.537	.167	3.220	.001	.209	.866	.028	3.220	.895
	[voice_similarity=	0[b]	.	.	.	.	.	.	.	.
	sex	.095	.128	.743	.458	-.157	.347	.002	.743	.115
	computer_experie	.117	.062	1.890	.060	-.005	.240	.010	1.890	.470
	Zconscientiousne	-.113	.083	-1.363	.174	-.277	.050	.005	1.363	.275
	Ztest_anxiety	-.288	.085	-3.372	.001	-.456	-.120	.030	3.372	.920
	[voice_familiarity= * [voice_similarity	-.622	.248	-2.505	.013	-1.110	-.134	.017	2.505	.705
	[voice_familiarity= * [voice_similarity	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarity= * [voice_similarity	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarity= * [voice_similarity	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarity= * Zconscientiousn	.256	.125	2.045	.042	.010	.502	.011	2.045	.532
	[voice_familiarity= * Zconscientiousn	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarity= * Ztest_anxiety	.069	.125	.554	.580	-.177	.315	.001	.554	.086
	[voice_familiarity= * Ztest_anxiety	0[b]	.	.	.	.	.	.	.	.
Learning_proce efficiency_TRN	Intercept	-.986	.346	-2.852	.005	-1.666	-.306	.022	2.852	.812
	[voice_familiarity=	.832	.175	4.753	.000	.488	1.176	.059	4.753	.997
	[voice_familiarity=	0[b]	.	.	.	.	.	.	.	.
	[voice_similarity=	.518	.162	3.205	.001	.200	.835	.028	3.205	.892
	[voice_similarity=	0[b]	.	.	.	.	.	.	.	.
	sex	.008	.124	.066	.948	-.235	.252	.000	.066	.050
	computer_experie	.111	.060	1.844	.066	-.007	.229	.009	1.844	.452
	Zconscientiousne	-.136	.081	-1.688	.092	-.294	.022	.008	1.688	.391
	Ztest_anxiety	-.292	.083	-3.527	.000	-.454	-.129	.033	3.527	.940
	[voice_familiarity= * [voice_similarity	-.563	.240	-2.343	.020	-1.035	-.090	.015	2.343	.647
	[voice_familiarity= * [voice_similarity	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarity= * [voice_similarity	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarity= * [voice_similarity	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarity= * Zconscientiousn	.249	.121	2.053	.041	.010	.487	.011	2.053	.535
	[voice_familiarity= * Zconscientiousn	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarity= * Ztest_anxiety	.068	.121	.558	.577	-.171	.306	.001	.558	.086
	[voice_familiarity= * Ztest_anxiety	0[b]	.	.	.	.	.	.	.	.

a. Computed using alpha = .05

b. This parameter is set to zero because it is redundant.

Estimated Marginal Means

1. voice_familiarity

Estimates

Dependent Variable	voice_familiarity	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Learning_process_ efficiency_REC	Familiar voice	.303[a]	.091	.124	.482
	Unfamiliar voice	-.224[a]	.084	-.389	-.060
Learning_process_ efficiency_TRN	Familiar voice	.310[a]	.088	.137	.483
	Unfamiliar voice	-.234[a]	.081	-.394	-.075

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5710, computer_experience = 4.2627, Zscore(cons) = -.0183948, Zscore(test_anxiety) = -.0167017.

Pairwise Comparisons

Dependent Vari	(I) voice_famil	(J) voice_famil	Mean Difference (I-J)	Std. Error	Sig.[a]	% Confidence Interval Difference[a]	
						ower Bound	pper Bound
Learning_proce efficiency_REC	Familiar voice	Unfamiliar voic	.527*	.124	.000	.283	.771
	Unfamiliar voi	Familiar voice	-.527*	.124	.000	-.771	-.283
Learning_proce efficiency_TRN	Familiar voice	Unfamiliar voic	.544*	.120	.000	.308	.781
	Unfamiliar voi	Familiar voice	-.544*	.120	.000	-.781	-.308

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Pillai's trace	.054	10.251[b]	2.000	362.000	.000	.054	20.502	.987
Wilks' lambda	.946	10.251[b]	2.000	362.000	.000	.054	20.502	.987
Hotelling's trac	.057	10.251[b]	2.000	362.000	.000	.054	20.502	.987
Roy's largest r	.057	10.251[b]	2.000	362.000	.000	.054	20.502	.987

Each F tests the multivariate effect of voice_familiarity. These tests are based on the linearly inde among the estimated marginal means.

a. Computed using alpha = .05

b. Exact statistic

Univariate Tests

Dependent Var		Sum of Squares	df	lean Squar	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Learning_proce efficiency_REC	Contra:	24.908	1	24.908	18.028	.000	.047	18.028	.989
	Error	501.530	363	1.382					
Learning_proce efficiency_TRN	Contra:	26.581	1	26.581	20.543	.000	.054	20.543	.995
	Error	469.700	363	1.294					

The F tests the effect of voice_familiarity. This test is based on the linearly independent pairwise cc means.

a. Computed using alpha = .05

2. voice_similarity

Estimates

Dependent Variable	voice_similarity	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Learning_process_ efficiency_REC	Same gender as studen	.152[a]	.086	-.016	.321
	Different gender than student	-.074[a]	.090	-.252	.104
Learning_process_ efficiency_TRN	Same gender as studen	.156[a]	.083	-.007	.319
	Different gender than student	-.080[a]	.087	-.252	.092

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5710, compu experience = 4.2627, Zscore(cons) = -.0183948, Zscore(test_anxiety) = -.0167017.

Pairwise Comparisons

Dependent Va	(I) voice_similarity	(J) voice_similarit	Mean Difference (I-J)	Std. Erro	Sig.[a]	% Confidence Interval Difference[a]	
						ower Boun	pper Boun
Learning_proc efficiency_REC	Same gender as s	Different gender t student	.226	.125	.072	-.020	.473
	Different gender t	Same gender as s	-.226	.125	.072	-.473	.020
Learning_proc efficiency_TRN	Same gender as s	Different gender t student	.236	.121	.052	-.002	.475
	Different gender t	Same gender as s	-.236	.121	.052	-.475	.002

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Pillai's trace	.010	1.890[b]	2.000	362.000	.153	.010	3.780	.392
Wilks' lambda	.990	1.890[b]	2.000	362.000	.153	.010	3.780	.392
Hotelling's trac	.010	1.890[b]	2.000	362.000	.153	.010	3.780	.392
Roy's largest r	.010	1.890[b]	2.000	362.000	.153	.010	3.780	.392

Each F tests the multivariate effect of voice_similarity. These tests are based on the linearly indepe among the estimated marginal means.

a. Computed using alpha = .05

b. Exact statistic

Univariate Tests

Dependent Var		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Learning_proce efficiency_REC	Contras	4.507	1	4.507	3.262	.072	.009	3.262	.437
	Error	501.530	363	1.382					
Learning_proce efficiency_TRN	Contras	4.904	1	4.904	3.790	.052	.010	3.790	.493
	Error	469.700	363	1.294					

The F tests the effect of voice_similarity. This test is based on the linearly independent pairwise coi means.

a. Computed using alpha = .05

3. voice_familiarity * voice_similarity

					95% Confidence Interval	
Dependent Varia	voice_familiar	voice_similarity	Mean	Std. Error	Lower Bound	Upper Bound
Learning_proces efficiency_REC	Familiar voice	Same gender as stu	.260[a]	.119	.026	.495
		Different gender tha student	.345[a]	.140	.070	.620
	Unfamiliar voi	Same gender as stu	.044[a]	.122	-.196	.284
		Different gender tha student	-.493[a]	.114	-.718	-.268
Learning_proces efficiency_TRN	Familiar voice	Same gender as stu	.287[a]	.115	.060	.514
		Different gender tha student	.333[a]	.135	.066	.599
	Unfamiliar voi	Same gender as stu	.024[a]	.118	-.208	.257
		Different gender tha student	-.493[a]	.111	-.711	-.276

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5710, comp Zscore(cons) = -.0183948, Zscore(test_anxiety) = -.0167017.

General Linear Model

Between-Subjects Factors

		Value Label	N
voice_familiarity	1.00	Familiar voice	172
	2.00	Unfamiliar voice	200
voice_similarity	1.00	Same gender as student	193
	2.00	Different gender than student	179

Descriptive Statistics

	voice_familiarity	voice_similarity	Mean	Std. Deviation	N
Task_efficiency_RE	Familiar voice	Same gender as stude	.2106	1.14811	99
		Different gender than student	.2597	1.15274	73
		Total	.2315	1.14696	172
	Unfamiliar voice	Same gender as stude	.0826	1.49405	94
		Different gender than student	-.4442	1.20885	106
		Total	-.1966	1.37249	200
	Total	Same gender as stude	.1483	1.32595	193
		Different gender than student	-.1571	1.23283	179
		Total	.0013	1.28935	372
Task_efficiency_TR	Familiar voice	Same gender as stude	.2008	1.06944	99
		Different gender than student	.0525	1.12629	73
		Total	.1379	1.09315	172
	Unfamiliar voice	Same gender as stude	-.0880	1.29791	94
		Different gender than student	-.1331	1.25244	106
		Total	-.1119	1.27100	200
	Total	Same gender as stude	.0601	1.19192	193
		Different gender than student	-.0574	1.20283	179
		Total	.0036	1.19701	372

Box's Test of Equality of Covariance Matrices [a]

Box's M	19.484
F	2.143
df1	9
df2	1137970
Sig.	.023

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientiousness+Ztest_anxiety+voice_familiarity * voice_similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Multivariate Tests[c]

Effect		Value	F	ypothesis (	Error df	Sig.	Partial Eta Squared	Noncent. Paramete	Observed Power[a]
Intercept	Pillai's Trace	.008	1.393[b]	2.000	61.000	.250	.008	2.785	.299
	Wilks' Lambd	.992	1.393[b]	2.000	61.000	.250	.008	2.785	.299
	Hotelling's Tr	.008	1.393[b]	2.000	61.000	.250	.008	2.785	.299
	Roy's Larges	.008	1.393[b]	2.000	61.000	.250	.008	2.785	.299
voice_familiarit	Pillai's Trace	.033	6.102[b]	2.000	61.000	.002	.033	12.205	.886
	Wilks' Lambd	.967	6.102[b]	2.000	61.000	.002	.033	12.205	.886
	Hotelling's Tr	.034	6.102[b]	2.000	61.000	.002	.033	12.205	.886
	Roy's Larges	.034	6.102[b]	2.000	61.000	.002	.033	12.205	.886
voice_similarity	Pillai's Trace	.010	1.871[b]	2.000	61.000	.155	.010	3.742	.389
	Wilks' Lambd	.990	1.871[b]	2.000	61.000	.155	.010	3.742	.389
	Hotelling's Tr	.010	1.871[b]	2.000	61.000	.155	.010	3.742	.389
	Roy's Larges	.010	1.871[b]	2.000	61.000	.155	.010	3.742	.389
sex	Pillai's Trace	.029	5.459[b]	2.000	61.000	.005	.029	10.918	.847
	Wilks' Lambd	.971	5.459[b]	2.000	61.000	.005	.029	10.918	.847
	Hotelling's Tr	.030	5.459[b]	2.000	61.000	.005	.029	10.918	.847
	Roy's Larges	.030	5.459[b]	2.000	61.000	.005	.029	10.918	.847
computer_expe	Pillai's Trace	.016	2.852[b]	2.000	61.000	.059	.016	5.704	.557
	Wilks' Lambd	.984	2.852[b]	2.000	61.000	.059	.016	5.704	.557
	Hotelling's Tr	.016	2.852[b]	2.000	61.000	.059	.016	5.704	.557
	Roy's Larges	.016	2.852[b]	2.000	61.000	.059	.016	5.704	.557
Zconscientious	Pillai's Trace	.010	1.892[b]	2.000	61.000	.152	.010	3.783	.393
	Wilks' Lambd	.990	1.892[b]	2.000	61.000	.152	.010	3.783	.393
	Hotelling's Tr	.010	1.892[b]	2.000	61.000	.152	.010	3.783	.393
	Roy's Larges	.010	1.892[b]	2.000	61.000	.152	.010	3.783	.393
Ztest_anxiety	Pillai's Trace	.030	5.601[b]	2.000	61.000	.004	.030	11.203	.856
	Wilks' Lambd	.970	5.601[b]	2.000	61.000	.004	.030	11.203	.856
	Hotelling's Tr	.031	5.601[b]	2.000	61.000	.004	.030	11.203	.856
	Roy's Larges	.031	5.601[b]	2.000	61.000	.004	.030	11.203	.856
voice_familiarit voice_similarity	Pillai's Trace	.052	9.973[b]	2.000	61.000	.000	.052	19.946	.984
	Wilks' Lambd	.948	9.973[b]	2.000	61.000	.000	.052	19.946	.984
	Hotelling's Tr	.055	9.973[b]	2.000	61.000	.000	.052	19.946	.984
	Roy's Larges	.055	9.973[b]	2.000	61.000	.000	.052	19.946	.984
voice_familiarit Zconscientious	Pillai's Trace	.011	2.032[b]	2.000	61.000	.133	.011	4.065	.418
	Wilks' Lambd	.989	2.032[b]	2.000	61.000	.133	.011	4.065	.418
	Hotelling's Tr	.011	2.032[b]	2.000	61.000	.133	.011	4.065	.418
	Roy's Larges	.011	2.032[b]	2.000	61.000	.133	.011	4.065	.418
voice_familiarit Ztest_anxiety	Pillai's Trace	.005	.892[b]	2.000	61.000	.411	.005	1.783	.204
	Wilks' Lambd	.995	.892[b]	2.000	61.000	.411	.005	1.783	.204
	Hotelling's Tr	.005	.892[b]	2.000	61.000	.411	.005	1.783	.204
	Roy's Larges	.005	.892[b]	2.000	61.000	.411	.005	1.783	.204

a. Computed using alpha = .05

b. Exact statistic

c. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientiousr
similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Levene's Test of Equality of Error Variances [a]

	F	df1	df2	Sig.
Task_efficiency_REC	2.628	3	368	.050
Task_efficiency_TRN	1.057	3	368	.367

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientiousness+Ztest_anxiety+voice_familiarity * voice_similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Tests of Between-Subjects Effects

Source	Dependent Va	ype III Su f Squares	df	ean Squa	F	Sig.	artial Eta Squared	Noncent. Paramete	Observed Power[a]
Corrected Mo	Task_efficien	71.911[b]	9	7.990	5.309	.000	.117	47.778	1.000
	Task_efficien	58.362[c]	9	6.485	4.961	.000	.110	44.646	.999
Intercept	Task_efficien	2.535	1	2.535	1.685	.195	.005	1.685	.253
	Task_efficien	.222	1	.222	.170	.680	.000	.170	.070
voice_familiari	Task_efficien	15.064	1	15.064	10.009	.002	.027	10.009	.884
	Task_efficien	3.540	1	3.540	2.708	.101	.007	2.708	.375
voice_similarit	Task_efficien	4.803	1	4.803	3.191	.075	.009	3.191	.429
	Task_efficien	1.269	1	1.269	.971	.325	.003	.971	.166
sex	Task_efficien	.296	1	.296	.197	.658	.001	.197	.073
	Task_efficien	6.999	1	6.999	5.354	.021	.015	5.354	.636
computer_exp	Task_efficien	7.034	1	7.034	4.673	.031	.013	4.673	.578
	Task_efficien	7.188	1	7.188	5.498	.020	.015	5.498	.648
Zconscientiou	Task_efficien	5.612	1	5.612	3.729	.054	.010	3.729	.486
	Task_efficien	3.782	1	3.782	2.893	.090	.008	2.893	.396
Ztest_anxiety	Task_efficien	11.449	1	11.449	7.607	.006	.021	7.607	.785
	Task_efficien	14.667	1	14.667	11.220	.001	.030	11.220	.916
voice_familiari voice_similarit	Task_efficien	7.308	1	7.308	4.855	.028	.013	4.855	.594
	Task_efficien	.405	1	.405	.310	.578	.001	.310	.086
voice_familiari Zconscientiou	Task_efficien	5.499	1	5.499	3.654	.057	.010	3.654	.479
	Task_efficien	4.826	1	4.826	3.691	.055	.010	3.691	.483
voice_familiari Ztest_anxiety	Task_efficien	2.665	1	2.665	1.771	.184	.005	1.771	.264
	Task_efficien	1.716	1	1.716	1.313	.253	.004	1.313	.208
Error	Task_efficien	544.849	362	1.505					
	Task_efficien	473.219	362	1.307					
Total	Task_efficien	616.761	372						
	Task_efficien	531.586	372						
Corrected Tot	Task_efficien	616.760	371						
	Task_efficien	531.581	371						

a. Computed using alpha = .05

b. R Squared = .117 (Adjusted R Squared = .095)

c. R Squared = .110 (Adjusted R Squared = .088)

Parameter Estimates

						% Confidence Interv		artial Eta	Noncent.	bserved
Dependent Va	Parameter	B	td. Erro	t	Sig.	wer Boun	pper Boun	Squared	aramete	Power[a]
Task_efficienc	Intercept	-.932	.373	-2.500	.013	-1.666	-.199	.017	2.500	.703
	[voice_familiarit	.696	.189	3.690	.000	.325	1.067	.036	3.690	.957
	[voice_familiarit	0[b]	.	.	.	.	.	.	.	.
	[voice_similarity	.520	.174	2.984	.003	.177	.862	.024	2.984	.845
	[voice_similarity	0[b]	.	.	.	.	.	.	.	.
	sex	-.059	.134	-.443	.658	-.322	.204	.001	.443	.073
	computer_expe	.140	.065	2.162	.031	.013	.268	.013	2.162	.578
	Zconscientious	.001	.087	.014	.988	-.170	.172	.000	.014	.050
	Ztest_anxiety	-.273	.089	-3.058	.002	-.448	-.097	.025	3.058	.862
	[voice_familiarit * [voice_similari	-.572	.259	-2.203	.028	-1.082	-.061	.013	2.203	.594
	[voice_familiarit * [voice_similari	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarit * [voice_similari	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarit * [voice_similari	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarit * Zconscientiou	.250	.131	1.911	.057	-.007	.507	.010	1.911	.479
	[voice_familiarit * Zconscientiou	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarit * Ztest_anxiety	.174	.131	1.331	.184	-.083	.431	.005	1.331	.264
	[voice_familiarit * Ztest_anxiety	0[b]	.	.	.	.	.	.	.	.
Task_efficienc	Intercept	-.264	.348	-.760	.448	-.948	.419	.002	.760	.118
	[voice_familiarit	.132	.176	.749	.454	-.214	.478	.002	.749	.116
	[voice_familiarit	0[b]	.	.	.	.	.	.	.	.
	[voice_similarity	.053	.162	.326	.745	-.266	.372	.000	.326	.062
	[voice_similarity	0[b]	.	.	.	.	.	.	.	.
	sex	-.288	.125	-2.314	.021	-.533	-.043	.015	2.314	.636
	computer_expe	.142	.060	2.345	.020	.023	.261	.015	2.345	.648
	Zconscientious	-.013	.081	-.166	.868	-.173	.146	.000	.166	.053
	Ztest_anxiety	-.280	.083	-3.368	.001	-.443	-.116	.030	3.368	.919
	[voice_familiarit * [voice_similari	.135	.242	.557	.578	-.341	.610	.001	.557	.086
	[voice_familiarit * [voice_similari	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarit * [voice_similari	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarit * [voice_similari	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarit * Zconscientiou	.234	.122	1.921	.055	-.006	.473	.010	1.921	.483
	[voice_familiarit * Zconscientiou	0[b]	.	.	.	.	.	.	.	.
	[voice_familiarit * Ztest_anxiety	.140	.122	1.146	.253	-.100	.379	.004	1.146	.208
	[voice_familiarit * Ztest_anxiety	0[b]	.	.	.	.	.	.	.	.

a. Computed using alpha = .05

b. This parameter is set to zero because it is redundant.

Estimated Marginal Means

1. voice_familiarity

Estimates

Dependent Variable	voice_familiarity	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Task_efficiency_REC	Familiar voice	.241[a]	.095	.053	.428
	Unfamiliar voice	-.162[a]	.087	-.334	.010
Task_efficiency_TRN	Familiar voice	.112[a]	.089	-.062	.287
	Unfamiliar voice	-.080[a]	.081	-.240	.080

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5699, computer_experience = 4.2634, Zscore(cons) = -.0163455, Zscore(test_anxiety) = -.019054

Pairwise Comparisons

Dependent Varia	(I) voice_famil	(J) voice_famil	Mean Difference (I-J)	Std. Error	Sig.[a]	% Confidence Interval Difference[a] ower Bound	pper Bound
Task_efficiency_	Familiar voice	Unfamiliar voic	.403*	.130	.002	.148	.658
	Unfamiliar voic	Familiar voice	-.403*	.130	.002	-.658	-.148
Task_efficiency_	Familiar voice	Unfamiliar voic	.193	.121	.112	-.045	.430
	Unfamiliar voic	Familiar voice	-.193	.121	.112	-.430	.045

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Pillai's trace	.032	5.947[b]	2.000	361.000	.003	.032	11.893	.877
Wilks' lambda	.968	5.947[b]	2.000	361.000	.003	.032	11.893	.877
Hotelling's trac	.033	5.947[b]	2.000	361.000	.003	.032	11.893	.877
Roy's largest r	.033	5.947[b]	2.000	361.000	.003	.032	11.893	.877

Each F tests the multivariate effect of voice_familiarity. These tests are based on the linearly indepe among the estimated marginal means.

a. Computed using alpha = .05

b. Exact statistic

Univariate Tests

Dependent Vari		Sum of Squares	df	lean Squar	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Task_efficiency	Contra	14.533	1	14.533	9.656	.002	.026	9.656	.873
	Error	544.849	362	1.505					
Task_efficiency	Contra	3.315	1	3.315	2.536	.112	.007	2.536	.355
	Error	473.219	362	1.307					

The F tests the effect of voice_familiarity. This test is based on the linearly independent pairwise cc means.

a. Computed using alpha = .05

2. voice_similarity

Estimates

Dependent Variable	voice_similarity	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Task_efficiency_RE(	Same gender as studer	.156[a]	.090	-.020	.332
	Different gender than student	-.078[a]	.094	-.263	.108
Task_efficiency_TRI	Same gender as studer	.076[a]	.083	-.088	.240
	Different gender than student	-.044[a]	.088	-.217	.129

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5699, com experience = 4.2634, Zscore(cons) = -.0163455, Zscore(test_anxiety) = -.0190549.

Pairwise Comparisons

Dependent Var	(I) voice_similarity	(J) voice_similarit	Mean Difference (I-J)	Std. Error	Sig.[a]	% Confidence Interval Difference[a] Lower Boun	Upper Boun
Task_efficiency	Same gender as :	Different gender t student	.234	.131	.075	-.024	.491
	Different gender t	Same gender as	-.234	.131	.075	-.491	.024
Task_efficiency	Same gender as :	Different gender t student	.120	.122	.325	-.120	.360
	Different gender t	Same gender as	-.120	.122	.325	-.360	.120

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Pillai's trace	.010	1.871[b]	2.000	361.000	.155	.010	3.742	.389
Wilks' lambda	.990	1.871[b]	2.000	361.000	.155	.010	3.742	.389
Hotelling's trac	.010	1.871[b]	2.000	361.000	.155	.010	3.742	.389
Roy's largest r	.010	1.871[b]	2.000	361.000	.155	.010	3.742	.389

Each F tests the multivariate effect of voice_similarity. These tests are based on the linearly indepe among the estimated marginal means.

a. Computed using alpha = .05

b. Exact statistic

Univariate Tests

Dependent Vari		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Task_efficiency_	Contras	4.803	1	4.803	3.191	.075	.009	3.191	.429
	Error	544.849	362	1.505					
Task_efficiency_	Contras	1.269	1	1.269	.971	.325	.003	.971	.166
	Error	473.219	362	1.307					

The F tests the effect of voice_similarity. This test is based on the linearly independent pairwise com means.

a. Computed using alpha = .05

3. voice_familiarity * voice_similarity

Dependent Variab	voice_familiar	voice_similarity	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Task_efficiency_F	Familiar voice	Same gender as stu	.215[a]	.125	-.031	.461
		Different gender tha student	.267[a]	.146	-.020	.554
	Unfamiliar voi	Same gender as stu	.098[a]	.127	-.153	.348
		Different gender tha student	-.422[a]	.119	-.657	-.187
Task_efficiency_T	Familiar voice	Same gender as stu	.206[a]	.117	-.023	.435
		Different gender tha student	.019[a]	.136	-.249	.286
	Unfamiliar voi	Same gender as stu	-.054[a]	.119	-.287	.180
		Different gender tha student	-.107[a]	.111	-.325	.112

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5699, compu Zscore(cons) = -.0163455, Zscore(test_anxiety) = -.0190549.

General Linear Model

Between-Subjects Factors

		Value Label	N
voice_familiarity	1.00	Familiar voice	172
	2.00	Unfamiliar voice	200
voice_similarity	1.00	Same gender as student	193
	2.00	Different gender than student	179

Descriptive Statistics

	voice_familiarit	voice_similarity	Mean	Std. Deviation	N
Three_dimensional_RE	Familiar voice	Same gender as stude	.3404	1.36049	99
		Different gender than student	.3898	1.35058	73
		Total	.3614	1.35255	172
	Unfamiliar voic	Same gender as stude	.0842	1.61888	94
		Different gender than student	-.6549	1.29377	106
		Total	-.3075	1.49824	200
	Total	Same gender as stude	.2156	1.49354	193
		Different gender than student	-.2288	1.41076	179
		Total	.0018	1.46927	372
Three_dimensional_TF	Familiar voice	Same gender as stude	.3324	1.25813	99
		Different gender than student	.2206	1.31658	73
		Total	.2849	1.28065	172
	Unfamiliar voic	Same gender as stude	-.0551	1.45850	94
		Different gender than student	-.4008	1.30851	106
		Total	-.2384	1.38833	200
	Total	Same gender as stude	.1436	1.36968	193
		Different gender than student	-.1474	1.34349	179
		Total	.0036	1.36311	372

Box's Test of Equality of Covariance Matrices [a]

Box's M	16.861
F	1.855
df1	9
df2	1137970
Sig.	.054

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientiousness+Ztest_anxiety+voice_familiarity * voice_similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Multivariate Tests[c]

Effect		Value	F	ypothesis d	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	Pillai's Trace	.008	1.370[b]	2.000	361.000	.255	.008	2.740	.294
	Wilks' Lambda	.992	1.370[b]	2.000	361.000	.255	.008	2.740	.294
	Hotelling's Tra	.008	1.370[b]	2.000	361.000	.255	.008	2.740	.294
	Roy's Largest	.008	1.370[b]	2.000	361.000	.255	.008	2.740	.294
voice_familiarity	Pillai's Trace	.054	10.241[b]	2.000	361.000	.000	.054	20.481	.986
	Wilks' Lambda	.946	10.241[b]	2.000	361.000	.000	.054	20.481	.986
	Hotelling's Tra	.057	10.241[b]	2.000	361.000	.000	.054	20.481	.986
	Roy's Largest	.057	10.241[b]	2.000	361.000	.000	.054	20.481	.986
voice_similarity	Pillai's Trace	.015	2.696[b]	2.000	361.000	.069	.015	5.392	.533
	Wilks' Lambda	.985	2.696[b]	2.000	361.000	.069	.015	5.392	.533
	Hotelling's Tra	.015	2.696[b]	2.000	361.000	.069	.015	5.392	.533
	Roy's Largest	.015	2.696[b]	2.000	361.000	.069	.015	5.392	.533
sex	Pillai's Trace	.026	4.905[b]	2.000	361.000	.008	.026	9.811	.804
	Wilks' Lambda	.974	4.905[b]	2.000	361.000	.008	.026	9.811	.804
	Hotelling's Tra	.027	4.905[b]	2.000	361.000	.008	.026	9.811	.804
	Roy's Largest	.027	4.905[b]	2.000	361.000	.008	.026	9.811	.804
computer_exper	Pillai's Trace	.012	2.229[b]	2.000	361.000	.109	.012	4.458	.453
	Wilks' Lambda	.988	2.229[b]	2.000	361.000	.109	.012	4.458	.453
	Hotelling's Tra	.012	2.229[b]	2.000	361.000	.109	.012	4.458	.453
	Roy's Largest	.012	2.229[b]	2.000	361.000	.109	.012	4.458	.453
Zconscientiousr	Pillai's Trace	.004	.739[b]	2.000	361.000	.478	.004	1.479	.175
	Wilks' Lambda	.996	.739[b]	2.000	361.000	.478	.004	1.479	.175
	Hotelling's Tra	.004	.739[b]	2.000	361.000	.478	.004	1.479	.175
	Roy's Largest	.004	.739[b]	2.000	361.000	.478	.004	1.479	.175
Ztest_anxiety	Pillai's Trace	.044	8.405[b]	2.000	361.000	.000	.044	16.811	.964
	Wilks' Lambda	.956	8.405[b]	2.000	361.000	.000	.044	16.811	.964
	Hotelling's Tra	.047	8.405[b]	2.000	361.000	.000	.044	16.811	.964
	Roy's Largest	.047	8.405[b]	2.000	361.000	.000	.044	16.811	.964
voice_familiarity voice_similarity	Pillai's Trace	.056	10.717[b]	2.000	361.000	.000	.056	21.435	.990
	Wilks' Lambda	.944	10.717[b]	2.000	361.000	.000	.056	21.435	.990
	Hotelling's Tra	.059	10.717[b]	2.000	361.000	.000	.056	21.435	.990
	Roy's Largest	.059	10.717[b]	2.000	361.000	.000	.056	21.435	.990
voice_familiarity Zconscientiousr	Pillai's Trace	.013	2.373[b]	2.000	361.000	.095	.013	4.745	.478
	Wilks' Lambda	.987	2.373[b]	2.000	361.000	.095	.013	4.745	.478
	Hotelling's Tra	.013	2.373[b]	2.000	361.000	.095	.013	4.745	.478
	Roy's Largest	.013	2.373[b]	2.000	361.000	.095	.013	4.745	.478
voice_familiarity Ztest_anxiety	Pillai's Trace	.002	.319[b]	2.000	361.000	.727	.002	.638	.101
	Wilks' Lambda	.998	.319[b]	2.000	361.000	.727	.002	.638	.101
	Hotelling's Tra	.002	.319[b]	2.000	361.000	.727	.002	.638	.101
	Roy's Largest	.002	.319[b]	2.000	361.000	.727	.002	.638	.101

a. Computed using alpha = .05

b. Exact statistic

c. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientiousness+Z similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Levene's Test of Equality of Error Variances [a]

	F	df1	df2	Sig.
Three_dimensional_REC	1.552	3	368	.201
Three_dimensional_TRN	.438	3	368	.726

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientiousness+Ztest_anxiety+voice_familiarity * voice_similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Tests of Between-Subjects Effects

Source	Dependent Vari	ype III Su f Square	df	ean Squa	F	Sig.	Partial Et Squared	Noncent Paramete	Observed Power [a]
Corrected Mo	Three_dimensio	123.404[b]	9	13.712	7.326	.000	.154	65.938	1.000
	Three_dimensio	96.363[c]	9	10.707	6.536	.000	.140	58.828	1.000
Intercept	Three_dimensio	2.740	1	2.740	1.464	.227	.004	1.464	.226
	Three_dimensio	.548	1	.548	.334	.563	.001	.334	.089
voice_familiar	Three_dimensio	35.943	1	35.943	19.205	.000	.050	19.205	.992
	Three_dimensio	19.032	1	19.032	11.618	.001	.031	11.618	.925
voice_similari	Three_dimensio	9.317	1	9.317	4.978	.026	.014	4.978	.605
	Three_dimensio	4.765	1	4.765	2.909	.089	.008	2.909	.398
sex	Three_dimensio	.161	1	.161	.086	.769	.000	.086	.060
	Three_dimensio	4.485	1	4.485	2.738	.099	.008	2.738	.379
computer_exp	Three_dimensio	7.158	1	7.158	3.825	.051	.010	3.825	.496
	Three_dimensio	7.285	1	7.285	4.447	.036	.012	4.447	.557
Zconscientiou	Three_dimensio	2.740	1	2.740	1.464	.227	.004	1.464	.226
	Three_dimensio	1.713	1	1.713	1.046	.307	.003	1.046	.175
Ztest_anxiety	Three_dimensio	23.840	1	23.840	12.738	.000	.034	12.738	.945
	Three_dimensio	27.530	1	27.530	16.806	.000	.044	16.806	.983
voice_familiar	Three_dimensio	14.832	1	14.832	7.925	.005	.021	7.925	.802
voice_similari	Three_dimensio	1.264	1	1.264	.771	.380	.002	.771	.141
voice_familiar	Three_dimensio	8.222	1	8.222	4.393	.037	.012	4.393	.552
Zconscientiou	Three_dimensio	7.542	1	7.542	4.604	.033	.013	4.604	.571
voice_familiar	Three_dimensio	1.152	1	1.152	.616	.433	.002	.616	.123
Ztest_anxiety	Three_dimensio	.656	1	.656	.400	.527	.001	.400	.097
Error	Three_dimensio	677.493	362	1.872					
	Three_dimensio	592.979	362	1.638					
Total	Three_dimensio	800.899	372						
	Three_dimensio	689.348	372						
Corrected Tot	Three_dimensio	800.898	371						
	Three_dimensio	689.343	371						

a. Computed using alpha = .05

b. R Squared = .154 (Adjusted R Squared = .133)

c. R Squared = .140 (Adjusted R Squared = .118)

Parameter Estimates

Dependent Vari	Parameter	B	td. Erro	t	Sig.	% Confidence Inter		artial Et	Noncent	bserved
						wer Bou	pper Bou	Squared	aramete	Power[a]
Three_dimensic	Intercept	-1.169	.416	-2.811	.005	-1.987	-.351	.021	2.811	.801
	[voice_familiar	1.041	.210	4.949	.000	.627	1.455	.063	4.949	.999
	[voice_familiar	0[b]	.	.	.	.	.	.	.	.
	[voice_similari	.733	.194	3.774	.000	.351	1.115	.038	3.774	.964
	[voice_similari	0[b]	.	.	.	.	.	.	.	.
	sex	-.044	.149	-.294	.769	-.337	.249	.000	.294	.060
	computer_exp	.142	.072	1.956	.051	-.001	.284	.010	1.956	.496
	Zconscientiou	-.065	.097	-.666	.506	-.255	.126	.001	.666	.102
	Ztest_anxiety	-.325	.099	-3.269	.001	-.520	-.129	.029	3.269	.903
	[voice_familiar * [voice_simila	-.814	.289	-2.815	.005	-1.383	-.245	.021	2.815	.802
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * Zconscientio	.305	.146	2.096	.037	.019	.592	.012	2.096	.552
	[voice_familiar * Zconscientio	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * Ztest_anxiety	.114	.146	.785	.433	-.172	.401	.002	.785	.123
	[voice_familiar * Ztest_anxiety	0[b]	.	.	.	.	.	.	.	.
Three_dimensic	Intercept	-.624	.389	-1.603	.110	-1.389	.141	.007	1.603	.359
	[voice_familiar	.580	.197	2.948	.003	.193	.967	.023	2.948	.836
	[voice_familiar	0[b]	.	.	.	.	.	.	.	.
	[voice_similari	.352	.182	1.936	.054	-.005	.709	.010	1.936	.489
	[voice_similari	0[b]	.	.	.	.	.	.	.	.
	sex	-.231	.139	-1.655	.099	-.505	.043	.008	1.655	.379
	computer_exp	.143	.068	2.109	.036	.010	.276	.012	2.109	.557
	Zconscientiou	-.077	.091	-.845	.399	-.255	.102	.002	.845	.134
	Ztest_anxiety	-.331	.093	-3.558	.000	-.514	-.148	.034	3.558	.944
	[voice_familiar * [voice_simila	-.238	.271	-.878	.380	-.770	.295	.002	.878	.141
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * Zconscientio	.292	.136	2.146	.033	.024	.560	.013	2.146	.571
	[voice_familiar * Zconscientio	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * Ztest_anxiety	.086	.136	.633	.527	-.182	.355	.001	.633	.097
	[voice_familiar * Ztest_anxiety	0[b]	.	.	.	.	.	.	.	.

a. Computed using alpha = .05

b. This parameter is set to zero because it is redundant.

Estimated Marginal Means

1. voice_familiarity

Estimates

Dependent Variable	voice_familiarity	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Three_dimensional_REC	Familiar voice	.366[a]	.106	.157	.575
	Unfamiliar voice	-.261[a]	.097	-.453	-.069
Three_dimensional_TRN	Familiar voice	.261[a]	.099	.066	.457
	Unfamiliar voice	-.194[a]	.091	-.373	-.014

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5699, com experience = 4.2634, Zscore(cons) = -.0163455, Zscore(test_anxiety) = -.0190549.

Pairwise Comparisons

Dependent Variabl	(I) voice_fami	(J) voice_fami	Mean Difference (I-J)	Std. Error	Sig.[a]	% Confidence Interval Difference[a] Lower Bound	% Confidence Interval Difference[a] Upper Bound
Three_dimensiona	Familiar voice	Unfamiliar voi	.627*	.145	.000	.342	.911
	Unfamiliar voi	Familiar voice	-.627*	.145	.000	-.911	-.342
Three_dimensiona	Familiar voice	Unfamiliar voi	.455*	.135	.001	.189	.721
	Unfamiliar voi	Familiar voice	-.455*	.135	.001	-.721	-.189

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Pillai's trace	.053	10.038[b]	2.000	361.000	.000	.053	20.075	.985
Wilks' lambda	.947	10.038[b]	2.000	361.000	.000	.053	20.075	.985
Hotelling's trac	.056	10.038[b]	2.000	361.000	.000	.053	20.075	.985
Roy's largest r	.056	10.038[b]	2.000	361.000	.000	.053	20.075	.985

Each F tests the multivariate effect of voice_familiarity. These tests are based on the linearly indep among the estimated marginal means.

a. Computed using alpha = .05

b. Exact statistic

Univariate Tests

Dependent Variat		Sum of Squares	df	ean Squar	F	Sig.	Partial Eta Squared	Noncent. Paramete	Observed Power[a]
Three_dimension	Contra	35.151	1	35.151	18.782	.000	.049	18.782	.991
	Error	77.493	362	1.872					
Three_dimension	Contra	18.513	1	18.513	11.302	.001	.030	11.302	.918
	Error	92.979	362	1.638					

The F tests the effect of voice_familiarity. This test is based on the linearly independent pairwise c

a. Computed using alpha = .05

2. voice_similarity

Estimates

Dependent Variable	voice_similarity	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Three_dimensional_RE	Same gender as stude	.215[a]	.100	.019	.412
	Different gender than student	-.110[a]	.105	-.317	.096
Three_dimensional_TR	Same gender as stude	.150[a]	.093	-.033	.334
	Different gender than student	-.083[a]	.098	-.276	.110

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5699, com experience = 4.2634, Zscore(cons) = -.0163455, Zscore(test_anxiety) = -.0190549.

Pairwise Comparisons

Dependent Varia	(I) voice_similari	(J) voice_similar	Mean Difference (I-J)	Std. Erro	Sig.[a]	5 Confidence Interva Difference[a] Lower Boun	Upper Boun
Three_dimensior	Same gender as	Different gender student	.326*	.146	.026	.039	.613
	Different gender	Same gender as	-.326*	.146	.026	-.613	-.039
Three_dimensior	Same gender as	Different gender student	.233	.137	.089	-.036	.502
	Different gender	Same gender as	-.233	.137	.089	-.502	.036

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Pillai's trace	.015	2.696[b]	2.000	361.000	.069	.015	5.392	.533
Wilks' lambda	.985	2.696[b]	2.000	361.000	.069	.015	5.392	.533
Hotelling's trace	.015	2.696[b]	2.000	361.000	.069	.015	5.392	.533
Roy's largest root	.015	2.696[b]	2.000	361.000	.069	.015	5.392	.533

Each F tests the multivariate effect of voice_similarity. These tests are based on the linearly ind among the estimated marginal means.

a. Computed using alpha = .05

b. Exact statistic

Univariate Tests

Dependent Variable		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Three_dimensiona	Contrast	9.317	1	9.317	4.978	.026	.014	4.978	.605
	Error	677.493	362	1.872					
Three_dimensiona	Contrast	4.765	1	4.765	2.909	.089	.008	2.909	.398
	Error	592.979	362	1.638					

The F tests the effect of voice_similarity. This test is based on the linearly independent pairwise comp

a. Computed using alpha = .05

3. voice_familiarity * voice_similarity

Dependent Variable	voice_familia	voice_similarity	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Three_dimensional_	Familiar voic	Same gender as st	.325[a]	.139	.051	.600
		Different gender tha student	.407[a]	.163	.086	.727
	Unfamiliar vo	Same gender as st	.106[a]	.142	-.174	.385
		Different gender tha student	-.627[a]	.133	-.889	-.366
Three_dimensional_	Familiar voic	Same gender as st	.318[a]	.130	.062	.575
		Different gender tha student	.204[a]	.152	-.096	.504
	Unfamiliar vo	Same gender as st	-.018[a]	.133	-.279	.243
		Different gender tha student	-.370[a]	.125	-.615	-.125

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5699, compu Zscore(cons) = -.0163455, Zscore(test_anxiety) = -.0190549.

General Linear Model

Between-Subjects Factors

		Value Label	N
voice_familiarity	1.00	Familiar voice	172
	2.00	Unfamiliar voice	200
voice_similarity	1.00	Same gender as student	193
	2.00	Different gender than student	179

Descriptive Statistics

	voice_familiarit	voice_similarity	Mean	Std. Deviation	N
Motivation_on_task_R	Familiar voice	Same gender as stud	-.0053	.49535	99
		Different gender than student	-.0827	.52396	73
		Total	-.0381	.50763	172
	Unfamiliar voic	Same gender as stud	-.0592	.46509	94
		Different gender than student	.1260	.74969	106
		Total	.0390	.63736	200
	Total	Same gender as stud	-.0315	.48036	193
		Different gender than student	.0409	.67317	179
		Total	.0033	.58151	372
Motivation_on_task_T	Familiar voice	Same gender as stud	.0665	.58281	99
		Different gender than student	.1339	.65501	73
		Total	.0951	.61354	172
	Unfamiliar voic	Same gender as stud	.0539	.78247	94
		Different gender than student	-.1896	.87794	106
		Total	-.0752	.84123	200
	Total	Same gender as stud	.0604	.68555	193
		Different gender than student	-.0577	.80848	179
		Total	.0036	.74854	372

Box's Test of Equality of Covariance Matrices[a]

Box's M	45.634
F	5.020
df1	9
df2	1137970
Sig.	.000

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientiousness+Ztest_anxiety+voice_familiarity * voice_similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Multivariate Tests[c]

Effect		Value	F	ypothesis	Error df	Sig.	Partial Eta Squared	Noncent. Paramete	Observed Power[a]
Intercept	Pillai's Trace	.028	5.256[b]	2.000	61.000	.006	.028	10.513	.832
	Wilks' Lamb	.972	5.256[b]	2.000	61.000	.006	.028	10.513	.832
	Hotelling's T	.029	5.256[b]	2.000	61.000	.006	.028	10.513	.832
	Roy's Larges	.029	5.256[b]	2.000	61.000	.006	.028	10.513	.832
voice_familiari	Pillai's Trace	.035	6.577[b]	2.000	61.000	.002	.035	13.154	.909
	Wilks' Lamb	.965	6.577[b]	2.000	61.000	.002	.035	13.154	.909
	Hotelling's T	.036	6.577[b]	2.000	61.000	.002	.035	13.154	.909
	Roy's Larges	.036	6.577[b]	2.000	61.000	.002	.035	13.154	.909
voice_similarit	Pillai's Trace	.013	2.459[b]	2.000	61.000	.087	.013	4.919	.493
	Wilks' Lamb	.987	2.459[b]	2.000	61.000	.087	.013	4.919	.493
	Hotelling's T	.014	2.459[b]	2.000	61.000	.087	.013	4.919	.493
	Roy's Larges	.014	2.459[b]	2.000	61.000	.087	.013	4.919	.493
sex	Pillai's Trace	.055	10.446[b]	2.000	61.000	.000	.055	20.892	.988
	Wilks' Lamb	.945	10.446[b]	2.000	61.000	.000	.055	20.892	.988
	Hotelling's T	.058	10.446[b]	2.000	61.000	.000	.055	20.892	.988
	Roy's Larges	.058	10.446[b]	2.000	61.000	.000	.055	20.892	.988
computer_exp	Pillai's Trace	.002	.442[b]	2.000	61.000	.643	.002	.883	.122
	Wilks' Lamb	.998	.442[b]	2.000	61.000	.643	.002	.883	.122
	Hotelling's T	.002	.442[b]	2.000	61.000	.643	.002	.883	.122
	Roy's Larges	.002	.442[b]	2.000	61.000	.643	.002	.883	.122
Zconscientiou	Pillai's Trace	.021	3.786[b]	2.000	61.000	.024	.021	7.571	.688
	Wilks' Lamb	.979	3.786[b]	2.000	61.000	.024	.021	7.571	.688
	Hotelling's T	.021	3.786[b]	2.000	61.000	.024	.021	7.571	.688
	Roy's Larges	.021	3.786[b]	2.000	61.000	.024	.021	7.571	.688
Ztest_anxiety	Pillai's Trace	.002	.436[b]	2.000	61.000	.647	.002	.872	.121
	Wilks' Lamb	.998	.436[b]	2.000	61.000	.647	.002	.872	.121
	Hotelling's T	.002	.436[b]	2.000	61.000	.647	.002	.872	.121
	Roy's Larges	.002	.436[b]	2.000	61.000	.647	.002	.872	.121
voice_familiari voice_similarit	Pillai's Trace	.047	8.866[b]	2.000	61.000	.000	.047	17.732	.971
	Wilks' Lamb	.953	8.866[b]	2.000	61.000	.000	.047	17.732	.971
	Hotelling's T	.049	8.866[b]	2.000	61.000	.000	.047	17.732	.971
	Roy's Larges	.049	8.866[b]	2.000	61.000	.000	.047	17.732	.971
voice_familiari Zconscientiou	Pillai's Trace	.000	.001[b]	2.000	61.000	.999	.000	.002	.050
	Wilks' Lamb	1.000	.001[b]	2.000	61.000	.999	.000	.002	.050
	Hotelling's T	.000	.001[b]	2.000	61.000	.999	.000	.002	.050
	Roy's Larges	.000	.001[b]	2.000	61.000	.999	.000	.002	.050
voice_familiari Ztest_anxiety	Pillai's Trace	.004	.673[b]	2.000	61.000	.511	.004	1.346	.163
	Wilks' Lamb	.996	.673[b]	2.000	61.000	.511	.004	1.346	.163
	Hotelling's T	.004	.673[b]	2.000	61.000	.511	.004	1.346	.163
	Roy's Larges	.004	.673[b]	2.000	61.000	.511	.004	1.346	.163

a. Computed using alpha = .05

b. Exact statistic

c. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscienti
similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Levene's Test of Equality of Error Variances [a]

	F	df1	df2	Sig.
Motivation_on_task_REC	2.795	3	368	.040
Motivation_on_task_TRN	4.660	3	368	.003

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientiousness+Ztest_anxiety+voice_familiarity * voice_similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Tests of Between-Subjects Effects

Source	Dependent Va	pe III Su f Square	df	ean Squa	F	Sig.	artial Et Squared	Noncent aramete	Observe Power[a]
Corrected M	Motivation_on_	9.790[b]	9	1.088	3.404	.000	.078	30.640	.986
	Motivation_on_	18.176[c]	9	2.020	3.854	.000	.087	34.685	.994
Intercept	Motivation_on_	3.045	1	3.045	9.529	.002	.026	9.529	.868
	Motivation_on_	3.104	1	3.104	5.924	.015	.016	5.924	.680
voice_familia	Motivation_on_	.304	1	.304	.952	.330	.003	.952	.164
	Motivation_on_	3.325	1	3.325	6.346	.012	.017	6.346	.710
voice_similar	Motivation_on_	.782	1	.782	2.448	.119	.007	2.448	.345
	Motivation_on_	.167	1	.167	.318	.573	.001	.318	.087
sex	Motivation_on_	5.232	1	5.232	6.374	.000	.043	16.374	.981
	Motivation_on_	7.958	1	7.958	5.186	.000	.040	15.186	.973
computer_ex	Motivation_on_	.275	1	.275	.861	.354	.002	.861	.152
	Motivation_on_	.059	1	.059	.112	.738	.000	.112	.063
Zconscientio	Motivation_on_	1.561	1	1.561	4.885	.028	.013	4.885	.597
	Motivation_on_	3.379	1	3.379	6.449	.012	.018	6.449	.717
Ztest_anxiety	Motivation_on_	.261	1	.261	.816	.367	.002	.816	.147
	Motivation_on_	.033	1	.033	.063	.802	.000	.063	.057
voice_familia voice_similar	Motivation_on_	1.030	1	1.030	3.224	.073	.009	3.224	.433
	Motivation_on_	2.959	1	2.959	5.646	.018	.015	5.646	.659
voice_familia Zconscientio	Motivation_on_	.000	1	.000	.001	.973	.000	.001	.050
	Motivation_on_	0E-007	1	0E-007	.000	.999	.000	.000	.050
voice_familia Ztest_anxiety	Motivation_on_	.223	1	.223	.699	.404	.002	.699	.133
	Motivation_on_	.657	1	.657	1.253	.264	.003	1.253	.201
Error	Motivation_on_	115.663	362	.320					
	Motivation_on_	189.701	362	.524					
Total	Motivation_on_	125.457	372						
	Motivation_on_	207.881	372						
Corrected To	Motivation_on_	125.453	371						
	Motivation_on_	207.876	371						

a. Computed using alpha = .05

b. R Squared = .078 (Adjusted R Squared = .055)

c. R Squared = .087 (Adjusted R Squared = .065)

Parameter Estimates

Dependent Vari	Parameter	B	td. Erro	t	Sig.	% Confidence Inter		artial Et Squared	Noncent aramete	bserved Power[a]
						wer Bour	pper Bour			
Motivation_on_t	Intercept	-.382	.172	-2.223	.027	-.720	-.044	.013	2.223	.601
	[voice_familiar	-.166	.087	-1.905	.058	-.337	.005	.010	1.905	.476
	[voice_familiar	0[b]	.	.	.	.	.	.	.	.
	[voice_similarit	-.202	.080	-2.514	.012	-.360	-.044	.017	2.514	.708
	[voice_similarit	0[b]	.	.	.	.	.	.	.	.
	sex	.249	.062	4.046	.000	.128	.370	.043	4.046	.981
	computer_exp	.028	.030	.928	.354	-.031	.087	.002	.928	.152
	Zconscientious	-.068	.040	-1.687	.092	-.146	.011	.008	1.687	.391
	Ztest_anxiety	-.053	.041	-1.295	.196	-.134	.028	.005	1.295	.253
	[voice_familiar * [voice_simila	.215	.120	1.795	.073	-.020	.450	.009	1.795	.433
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * Zconscientio	.002	.060	.034	.973	-.116	.120	.000	.034	.050
	[voice_familiar * Zconscientio	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * Ztest_anxiety	.050	.060	.836	.404	-.068	.169	.002	.836	.133
	[voice_familiar * Ztest_anxiety	0[b]	.	.	.	.	.	.	.	.
Motivation_on_t	Intercept	-.726	.220	-3.299	.001	-1.159	-.293	.029	3.299	.908
	[voice_familiar	.375	.111	3.366	.001	.156	.594	.030	3.366	.919
	[voice_familiar	0[b]	.	.	.	.	.	.	.	.
	[voice_similarit	.225	.103	2.194	.029	.023	.428	.013	2.194	.590
	[voice_similarit	0[b]	.	.	.	.	.	.	.	.
	sex	.307	.079	3.897	.000	.152	.462	.040	3.897	.973
	computer_exp	.013	.038	.335	.738	-.062	.088	.000	.335	.063
	Zconscientious	-.098	.051	-1.909	.057	-.199	.003	.010	1.909	.478
	Ztest_anxiety	-.053	.053	-1.010	.313	-.157	.050	.003	1.010	.172
	[voice_familiar * [voice_simila	-.364	.153	-2.376	.018	-.665	-.063	.015	2.376	.659
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * [voice_simila	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * Zconscientio	E-005	.077	-.001	.999	-.152	.152	.000	.001	.050
	[voice_familiar * Zconscientio	0[b]	.	.	.	.	.	.	.	.
	[voice_familiar * Ztest_anxiety	.086	.077	1.119	.264	-.065	.238	.003	1.119	.201
	[voice_familiar * Ztest_anxiety	0[b]	.	.	.	.	.	.	.	.

a. Computed using alpha = .05

b. This parameter is set to zero because it is redundant.

Estimated Marginal Means

1. voice_familiarity

Estimates

Dependent Variable	voice_familiarity	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Motivation_on_task_REC	Familiar voice	-.031[a]	.044	-.117	.056
	Unfamiliar voice	.029[a]	.040	-.051	.108
Motivation_on_task_TRN	Familiar voice	.117[a]	.056	.007	.228
	Unfamiliar voice	-.074[a]	.052	-.175	.028

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5699, computer_experience = 4.2634, Zscore(cons) = -.0163455, Zscore(test_anxiety) = -.0190549

Pairwise Comparisons

Dependent Variab	(I) voice_fami	(J) voice_fam	Mean Difference (I-J)	Std. Error	Sig.[a]	% Confidence Interval Difference[a]	
						ower Boun	pper Boun
Motivation_on_tas	Familiar voice	Unfamiliar voi	-.059	.060	.322	-.177	.058
	Unfamiliar voi	Familiar voice	.059	.060	.322	-.058	.177
Motivation_on_tas	Familiar voice	Unfamiliar voi	.191*	.077	.013	.041	.342
	Unfamiliar voi	Familiar voice	-.191*	.077	.013	-.342	-.041

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Pillai's trace	.035	6.544[b]	2.000	361.000	.002	.035	13.087	.908
Wilks' lambda	.965	6.544[b]	2.000	361.000	.002	.035	13.087	.908
Hotelling's trac	.036	6.544[b]	2.000	361.000	.002	.035	13.087	.908
Roy's largest r	.036	6.544[b]	2.000	361.000	.002	.035	13.087	.908

Each F tests the multivariate effect of voice_familiarity. These tests are based on the linearly indepe among the estimated marginal means.

a. Computed using alpha = .05

b. Exact statistic

Univariate Tests

Dependent Variat		Sum of Squares	df	ean Squar	F	Sig.	Partial Eta Squared	Noncent. Paramete	Observed Power[a]
Motivation_on_ta:	Contra	.315	1	.315	.985	.322	.003	.985	.168
	Error	15.663	362	.320					
Motivation_on_ta:	Contra	3.270	1	3.270	6.241	.013	.017	6.241	.702
	Error	89.701	362	.524					

The F tests the effect of voice_familiarity. This test is based on the linearly independent pairwise c

a. Computed using alpha = .05

2. voice_similarity

Estimates

Dependent Variable	voice_similarity	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Motivation_on_task_RI	Same gender as stude	-.048[a]	.041	-.129	.033
	Different gender than student	.046[a]	.043	-.039	.132
Motivation_on_task_TF	Same gender as stude	.044[a]	.053	-.060	.147
	Different gender than student	4.5E-006[a]	.056	-.109	.109

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5699, comp experience = 4.2634, Zscore(cons) = -.0163455, Zscore(test_anxiety) = -.0190549.

Pairwise Comparisons

Dependent Varia	(I) voice_similarit	(J) voice_similari	Mean Difference (I-J)	Std. Erro	Sig.[a]	5 Confidence Interval Difference[a] Lower Boun	Upper Boun
Motivation_on_ta	Same gender as	Different gender student	-.094	.060	.119	-.213	.024
	Different gender	Same gender as	.094	.060	.119	-.024	.213
Motivation_on_ta	Same gender as	Different gender student	.044	.077	.573	-.108	.196
	Different gender	Same gender as	-.044	.077	.573	-.196	.108

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Pillai's trace	.013	2.459[b]	2.000	361.000	.087	.013	4.919	.493
Wilks' lambda	.987	2.459[b]	2.000	361.000	.087	.013	4.919	.493
Hotelling's trac	.014	2.459[b]	2.000	361.000	.087	.013	4.919	.493
Roy's largest r	.014	2.459[b]	2.000	361.000	.087	.013	4.919	.493

Each F tests the multivariate effect of voice_similarity. These tests are based on the linearly indep among the estimated marginal means.

a. Computed using alpha = .05

b. Exact statistic

Univariate Tests

Dependent Variab		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Motivation_on_tas	Contra	.782	1	.782	2.448	.119	.007	2.448	.345
	Error	15.663	362	.320					
Motivation_on_tas	Contra	.167	1	.167	.318	.573	.001	.318	.087
	Error	89.701	362	.524					

The F tests the effect of voice_similarity. This test is based on the linearly independent pairwise cor

a. Computed using alpha = .05

3. voice_familiarity * voice_similarity

Dependent Variable	voice_familia	voice_similarity	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Motivation_on_task	Familiar voic	Same gender as st	-.024[a]	.058	-.138	.089
		Different gender th student	-.037[a]	.067	-.169	.095
	Unfamiliar vo	Same gender as st	-.072[a]	.059	-.188	.043
		Different gender th student	.129[a]	.055	.021	.238
Motivation_on_task	Familiar voic	Same gender as st	.048[a]	.074	-.097	.193
		Different gender th student	.187[a]	.086	.017	.356
	Unfamiliar vo	Same gender as st	.039[a]	.075	-.109	.187
		Different gender th student	-.187[a]	.070	-.325	-.048

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5699, comp Zscore(cons) = -.0163455, Zscore(test_anxiety) = -.0190549.

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
voice_familiarity	1.00	Familiar voice	180
	2.00	Unfamiliar voice	202
voice_similarity	1.00	Same gender as student	202
	2.00	Different gender than student	180

Descriptive Statistics

Dependent Variable: משוב_הקלטה

voice_familiarity	voice_similarity	Mean	Std. Deviation	N
Familiar voice	Same gender as student	4.6190	.83694	106
	Different gender than student	4.7047	.72748	74
	Total	4.6542	.79279	180
Unfamiliar voice	Same gender as student	4.3475	.86830	96
	Different gender than student	4.3605	.80165	106
	Total	4.3543	.83192	202
Total	Same gender as student	4.4899	.86066	202
	Different gender than student	4.5020	.78844	180
	Total	4.4956	.82636	382

Levene's Test of Equality of Error Variances[a]

Dependent Variable: משוב_הקלטה

F	df1	df2	Sig.
.511	3	378	.675

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+voice_familiarity+voice_similarity+sex+computer_experience+Zconscientiousness+Ztest_anxiety+voice_familiarity * voice_similarity+voice_familiarity * Zconscientiousness+voice_familiarity * Ztest_anxiety

Tests of Between-Subjects Effects

Dependent Variable: משוב_הקלטה

Source	ype III Sun of Squares	df	lean Squar	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Corrected Mode	24.293[b]	9	2.699	4.257	.000	.093	38.311	.997
Intercept	211.452	1	211.452	333.470	.000	.473	333.470	1.000
voice_familiarity	7.908	1	7.908	12.471	.000	.032	12.471	.941
voice_similarity	.308	1	.308	.486	.486	.001	.486	.107
sex	.120	1	.120	.190	.663	.001	.190	.072
computer_exper	2.619	1	2.619	4.131	.043	.011	4.131	.527
Zconscientiousn	.862	1	.862	1.359	.244	.004	1.359	.214
Ztest_anxiety	7.498	1	7.498	11.824	.001	.031	11.824	.929
voice_familiarity voice_similarity	.187	1	.187	.295	.587	.001	.295	.084
voice_familiarity Zconscientiousn	.386	1	.386	.609	.436	.002	.609	.122
voice_familiarity Ztest_anxiety	.003	1	.003	.004	.948	.000	.004	.050
Error	235.883	372	.634					
Total	7980.698	382						
Corrected Total	260.176	381						

a. Computed using alpha = .05

b. R Squared = .093 (Adjusted R Squared = .071)

Estimated Marginal Means

1. voice_familiarity

Dependent Variable: משוב_הקלטה

voice_familiarity	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Familiar voice	4.657[a]	.061	4.537	4.776
Unfamiliar voice	4.363[a]	.056	4.252	4.474

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5654, computer_experience = 4.2565, Zscore(cons) = .0000000, Zscore(test_anxiety) = .0000000.

2. voice_similarity

Dependent Variable: משוב_הקלטה

voice_similarity	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Same gender as student	4.481[a]	.057	4.369	4.592
Different gender than student	4.539[a]	.061	4.419	4.659

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5654, computer_experience = 4.2565, Zscore(cons) = .0000000, Zscore(test_anxiety) = .0000000.

3. voice_familiarity * voice_similarity

Dependent Variable: משוב_הקלטה

voice_familiarity	voice_similarity	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Familiar voice	Same gender as studen	4.605[a]	.078	4.452	4.758
	Different gender than student	4.709[a]	.094	4.524	4.893
Unfamiliar voice	Same gender as studen	4.356[a]	.082	4.195	4.517
	Different gender than student	4.369[a]	.077	4.217	4.522

a. Covariates appearing in the model are evaluated at the following values: sex = 1.5654, computer_experience = 4.2565, Zscore(cons) = .0000000, Zscore(test_anxiety) = .00000C

General Linear Model

Tests of Between-Subjects Effects

Source	Dependent Vari	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Learning_proce efficiency_REC	43.601[a]	3	14.534	9.914	.000
	Learning_proce efficiency_TRN	45.538[b]	3	15.179	11.011	.000
Intercept	Learning_proce efficiency_REC	.278	1	.278	.190	.664
	Learning_proce efficiency_TRN	.276	1	.276	.200	.655
voice_sim_t_s_4_t	Learning_proce efficiency_REC	43.601	3	14.534	9.914	.000
	Learning_proce efficiency_TRN	45.538	3	15.179	11.011	.000
Error	Learning_proce efficiency_REC	540.918	369	1.466		
	Learning_proce efficiency_TRN	508.702	369	1.379		
Total	Learning_proce efficiency_REC	584.520	373			
	Learning_proce efficiency_TRN	554.241	373			
Corrected Total	Learning_proce efficiency_REC	584.519	372			
	Learning_proce efficiency_TRN	554.241	372			

a. R Squared = .075 (Adjusted R Squared = .067)

b. R Squared = .082 (Adjusted R Squared = .075)

Estimated Marginal Means

voice_sim_t_s_4_types

Pairwise Comparisons

Dependent Variabl	(I) voice_sim_t_s_4_types	(J) voice_sim_t_s_4_types	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
						Lower Bound	Upper Bound
Learning_process_efficiency_REC	Familiar voice same gender	familiar voice different gende	-.018	.186	1.000	-.512	.477
		unfamiliar voic same gender	.256	.174	.847	-.205	.718
		unfamiliar voic different gende	.806*	.169	.000	.358	1.253
	familiar voice different gende	Familiar voice same gender	.018	.186	1.000	-.477	.512
		unfamiliar voic same gender	.274	.189	.886	-.227	.775
		unfamiliar voic different gende	.823*	.184	.000	.335	1.312
	unfamiliar voice same gender	Familiar voice same gender	-.256	.174	.847	-.718	.205
		familiar voice different gende	-.274	.189	.886	-.775	.227
		unfamiliar voic different gende	.549*	.172	.009	.094	1.004
	unfamiliar voice different gende	Familiar voice same gender	-.806*	.169	.000	-1.253	-.358
		familiar voice different gende	-.823*	.184	.000	-1.312	-.335
		unfamiliar voic same gender	-.549*	.172	.009	-1.004	-.094
Learning_process_efficiency_TRN	Familiar voice same gender	familiar voice different gende	.004	.181	1.000	-.476	.483
		unfamiliar voic same gender	.311	.169	.394	-.136	.759
		unfamiliar voic different gende	.834*	.164	.000	.400	1.268
	familiar voice different gende	Familiar voice same gender	-.004	.181	1.000	-.483	.476
		unfamiliar voic same gender	.308	.183	.564	-.178	.793
		unfamiliar voic different gende	.830*	.179	.000	.356	1.304
	unfamiliar voice same gender	Familiar voice same gender	-.311	.169	.394	-.759	.136
		familiar voice different gende	-.308	.183	.564	-.793	.178
		unfamiliar voic different gende	.523*	.166	.011	.081	.964
	unfamiliar voice different gende	Familiar voice same gender	-.834*	.164	.000	-1.268	-.400
		familiar voice different gende	-.830*	.179	.000	-1.304	-.356
		unfamiliar voic same gender	-.523*	.166	.011	-.964	-.081

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

General Linear Model

Estimated Marginal Means

voice_sim_t_s_4_types

Pairwise Comparisons

Dependent Variable	(I) voice_sim_t_s_4_types	(J) voice_sim_t_s_4_types	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
						Lower Bound	Upper Bound
Learning_process_efficiency_REC	Familiar voice same gender	familiar voice different gender	-.085	.185	1.000	-.577	.407
		unfamiliar voice same gender	.222	.170	1.000	-.230	.673
		unfamiliar voice different gender	.759*	.165	.000	.321	1.198
	familiar voice different gender	Familiar voice same gender	.085	.185	1.000	-.407	.577
		unfamiliar voice same gender	.306	.187	.611	-.189	.802
		unfamiliar voice different gender	.844*	.181	.000	.364	1.323
	unfamiliar voice same gender	Familiar voice same gender	-.222	.170	1.000	-.673	.230
		familiar voice different gender	-.306	.187	.611	-.802	.189
		unfamiliar voice different gender	.537*	.167	.008	.095	.980
	unfamiliar voice different gender	Familiar voice same gender	-.759*	.165	.000	-1.198	-.321
		familiar voice different gender	-.844*	.181	.000	-1.323	-.364
		unfamiliar voice same gender	-.537*	.167	.008	-.980	-.095
Learning_process_efficiency_TRN	Familiar voice same gender	familiar voice different gender	-.045	.179	1.000	-.521	.431
		unfamiliar voice same gender	.269	.165	.622	-.168	.705
		unfamiliar voice different gender	.786*	.160	.000	.362	1.211
	familiar voice different gender	Familiar voice same gender	.045	.179	1.000	-.431	.521
		unfamiliar voice same gender	.314	.181	.500	-.166	.794
		unfamiliar voice different gender	.832*	.175	.000	.367	1.296
	unfamiliar voice same gender	Familiar voice same gender	-.269	.165	.622	-.705	.168
		familiar voice different gender	-.314	.181	.500	-.794	.166
		unfamiliar voice different gender	.518*	.162	.009	.089	.946
	unfamiliar voice different gender	Familiar voice same gender	-.786*	.160	.000	-1.211	-.362
		familiar voice different gender	-.832*	.175	.000	-1.296	-.367
		unfamiliar voice same gender	-.518*	.162	.009	-.946	-.089

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

General Linear Model

Estimated Marginal Means

voice_sim_t_s_4_types

Pairwise Comparisons

Dependent Variable	(I) voice_sim_t_s_4_types	(J) voice_sim_t_s_4_types	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
Task_efficiency_REC	Familiar voice same gender	familiar voice different gender	-.052	.194	1.000	-.566	.463
		unfamiliar voice same gender	.125	.178	1.000	-.348	.597
		unfamiliar voice different gender	.644*	.173	.001	.185	1.104
	familiar voice different gender	Familiar voice same gender	.052	.194	1.000	-.463	.566
		unfamiliar voice same gender	.177	.195	1.000	-.341	.694
		unfamiliar voice different gender	.696*	.189	.002	.196	1.197
	unfamiliar voice same gender	Familiar voice same gender	-.125	.178	1.000	-.597	.348
		familiar voice different gender	-.177	.195	1.000	-.694	.341
		unfamiliar voice different gender	.520*	.174	.018	.058	.982
	unfamiliar voice different gender	Familiar voice same gender	-.644*	.173	.001	-1.104	-.185
		familiar voice different gender	-.696*	.189	.002	-1.197	-.196
		unfamiliar voice same gender	-.520*	.174	.018	-.982	-.058
Task_efficiency_TRN	Familiar voice same gender	familiar voice different gender	.188	.181	1.000	-.292	.667
		unfamiliar voice same gender	.266	.166	.657	-.174	.707
		unfamiliar voice different gender	.319	.161	.291	-.109	.747
	familiar voice different gender	Familiar voice same gender	-.188	.181	1.000	-.667	.292
		unfamiliar voice same gender	.079	.182	1.000	-.403	.561
		unfamiliar voice different gender	.132	.176	1.000	-.335	.598
	unfamiliar voice same gender	Familiar voice same gender	-.266	.166	.657	-.707	.174
		familiar voice different gender	-.079	.182	1.000	-.561	.403
		unfamiliar voice different gender	.053	.162	1.000	-.378	.484
	unfamiliar voice different gender	Familiar voice same gender	-.319	.161	.291	-.747	.109
		familiar voice different gender	-.132	.176	1.000	-.598	.335
		unfamiliar voice same gender	-.053	.162	1.000	-.484	.378

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

General Linear Model

Estimated Marginal Means

voice_sim_t_s_4_types

Pairwise Comparisons

Dependent Variable	(I) voice_sim_t_s_4_types	(J) voice_sim_t_s_4_types	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
Three_dimensional_RE(	Familiar voice same gender	familiar voice different gende	-.081	.216	1.000	-.655	.492
		unfamiliar voice same gender	.227	.199	1.000	-.300	.754
		unfamiliar voice different gende	.960*	.193	.000	.448	1.472
	familiar voice different gender	Familiar voice same gender	.081	.216	1.000	-.492	.655
		unfamiliar voice same gender	.308	.217	.943	-.269	.885
		unfamiliar voice different gende	1.041*	.210	.000	.483	1.599
	unfamiliar voice same gender	Familiar voice same gender	-.227	.199	1.000	-.754	.300
		familiar voice different gende	-.308	.217	.943	-.885	.269
		unfamiliar voice different gende	.733*	.194	.001	.218	1.248
	unfamiliar voice different gender	Familiar voice same gender	-.960*	.193	.000	-1.472	-.448
		familiar voice different gende	-1.041*	.210	.000	-1.599	-.483
		unfamiliar voice same gender	-.733*	.194	.001	-1.248	-.218
Three_dimensional_TRI	Familiar voice same gender	familiar voice different gende	.114	.202	1.000	-.423	.651
		unfamiliar voice same gender	.343	.186	.396	-.150	.835
		unfamiliar voice different gende	.694*	.181	.001	.215	1.173
	familiar voice different gender	Familiar voice same gender	-.114	.202	1.000	-.651	.423
		unfamiliar voice same gender	.228	.203	1.000	-.311	.768
		unfamiliar voice different gende	.580*	.197	.020	.058	1.102
	unfamiliar voice same gender	Familiar voice same gender	-.343	.186	.396	-.835	.150
		familiar voice different gende	-.228	.203	1.000	-.768	.311
		unfamiliar voice different gende	.352	.182	.322	-.130	.834
	unfamiliar voice different gender	Familiar voice same gender	-.694*	.181	.001	-1.173	-.215
		familiar voice different gende	-.580*	.197	.020	-1.102	-.058
		unfamiliar voice same gender	-.352	.182	.322	-.834	.130

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

General Linear Model

Estimated Marginal Means

voice_sim_t_s_4_types

Pairwise Comparisons

Dependent Variable	(I) voice_sim_t_s_4_types	(J) voice_sim_t_s_4_types	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
Motivation_on_task_RE	Familiar voice same gender	familiar voice different gende	.013	.089	1.000	-.224	.250
		unfamiliar voice same gender	.049	.082	1.000	-.169	.267
		unfamiliar voice different gende	-.153	.080	.337	-.364	.059
	familiar voice different gender	Familiar voice same gender	-.013	.089	1.000	-.250	.224
		unfamiliar voice same gender	.036	.090	1.000	-.202	.274
		unfamiliar voice different gende	-.166	.087	.345	-.396	.065
	unfamiliar voice same gender	Familiar voice same gender	-.049	.082	1.000	-.267	.169
		familiar voice different gende	-.036	.090	1.000	-.274	.202
		unfamiliar voice different gende	-.202	.080	.074	-.415	.011
	unfamiliar voice different gender	Familiar voice same gender	.153	.080	.337	-.059	.364
		familiar voice different gende	.166	.087	.345	-.065	.396
		unfamiliar voice same gender	.202	.080	.074	-.011	.415
Motivation_on_task_TR	Familiar voice same gender	familiar voice different gende	-.138	.114	1.000	-.442	.165
		unfamiliar voice same gender	.011	.105	1.000	-.268	.290
		unfamiliar voice different gende	.236	.102	.127	-.034	.507
	familiar voice different gender	Familiar voice same gender	.138	.114	1.000	-.165	.442
		unfamiliar voice same gender	.149	.115	1.000	-.156	.455
		unfamiliar voice different gende	.375*	.111	.005	.079	.670
	unfamiliar voice same gender	Familiar voice same gender	-.011	.105	1.000	-.290	.268
		familiar voice different gende	-.149	.115	1.000	-.455	.156
		unfamiliar voice different gende	.225	.103	.173	-.047	.498
	unfamiliar voice different gender	Familiar voice same gender	-.236	.102	.127	-.507	.034
		familiar voice different gende	-.375*	.111	.005	-.670	-.079
		unfamiliar voice same gender	-.225	.103	.173	-.498	.047

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Oneway

Descriptives

Motivation_on_task_REC

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
וורד	128	.0774	.59140	.05227	-.0260	.1808	-1.62	1.70
פאור פויינט	124	-.0471	.46646	.04189	-.1300	.0358	-1.18	1.79
אקסל	121	-.0336	.67476	.06134	-.1550	.0879	-3.42	1.30
Total	373	.0000	.58428	.03025	-.0595	.0595	-3.42	1.79

ANOVA

Motivation_on_task_REC

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.178	2	.589	1.733	.178
Within Groups	125.817	370	.340		
Total	126.996	372			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Motivation_on_task_REC
Scheffe

(I) חומר_לימוד	(J) חומר_לימוד	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
וורד	פאור פויינט	.12451	.07348	.239	-.0561	.3051
	אקסל	.11096	.07394	.325	-.0708	.2927
פאור פויינט	וורד	-.12451	.07348	.239	-.3051	.0561
	אקסל	-.01355	.07452	.984	-.1967	.1696
אקסל	וורד	-.11096	.07394	.325	-.2927	.0708
	פאור פויינט	.01355	.07452	.984	-.1696	.1967

Homogeneous Subsets

Motivation_on_task_REC

Scheffe [a,b]

חומר_לימוד	N	Subset for alpha = .05
		1
פאור פויינט	124	-.0471
אקסל	121	-.0336
וורד	128	.0774
Sig.		.244

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 124.267.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Appendix V - MANCOVA F-statistics and significance of the indices

Dependent Variables													
	LPE			TE			3D-E			MT			NVSC-A
Sources	F-Total[a]	F-Rec[b]	F-Trn[b]	F-Total[a]	F-Rec[b]	F-Trn[b]	F-Total[a]	F-Rec[b]	F-Trn[b]	F-Total[a]	F-Rec[b]	F-Trn[b]	F
Voice-familiarity	10.46***	18.42***	20.96***	6.10***	10.00***	2.70*	10.24***	19.20***	11.61***	6.58***	0.95	6.35**	12.47***
Gender-similarity	1.89	3.26*	3.79*	1.87	3.19*	0.97	2.7*	4.97**	2.90*	2.46	2.44	0.31	0.49
Gender (Control)	1.64	0.55	0.00	5.46***	0.19	5.35**	4.91***	0.08	2.73*	10.45***	16.37***	15.18***	0.19
Computer experience (control)	1.81	3.57*	3.39*	2.85*	4.67**	5.49**	2.23	3.82*	4.44**	0.44	0.86	0.11	4.13**
conscientiousness (Z-SCORE)	0.61	0.05	0.03	1.89	3.72*	2.89*	0.74	1.46	1.04	3.79**	4.88**	6.44**	1.36
Test Anxiety (Z-SCORE)	8.57***	15.48***	17.11***	5.60***	7.60***	11.22***	8.41***	12.73***	16.80***	0.44	0.81	0.06	11.82***
Voice_familiarity * Gender_similarity	3.13**	6.27**	5.49**	9.97***	4.85**	0.31	10.72***	7.92***	0.77	8.87***	3.22*	5.64**	0.29
voice_familiarity * Zcons	2.17	4.18**	4.21**	2.03	3.65*	3.69*	2.37	4.39**	4.60**	0.00	0.00	0.00	0.60
voice_familiarity * Ztest_anxiety	0.16	0.30	0.31	0.89	1.77	1.31	0.32	0.61	0.40	0.67	0.69	1.25	0.004

*P<0.10, **P<0.05 , ***p<0.01 a- F-Statistics in Multivariate test b- F-Statistics in ***Tests of Between-Subjects Effects***

Appendix W -T-Tests – students' preferences and efficiency of learning

T-Test- Cognitive load and performance measures in relation to students' preferences

Group Statistics

	groups_B_and_famili	N	Mean	Std. Deviation	Std. Error Mean
cognitive_load_learning	prefers a familiar voice and heard a familiar voice	98	4.4592	1.86762	.18866
	prefers a familiar voice and heard an unfamiliar voice	107	5.4019	1.76368	.17050
cognitive_load_test_RE(	prefers a familiar voice and heard a familiar voice	96	4.6146	1.80275	.18399
	prefers a familiar voice and heard an unfamiliar voice	106	5.4623	2.00559	.19480
cognitive_load_test_TRI	prefers a familiar voice and heard a familiar voice	95	6.1684	1.86029	.19086
	prefers a familiar voice and heard an unfamiliar voice	106	6.2358	2.07273	.20132
original_test_REC_score	prefers a familiar voice and heard a familiar voice	96	80.2917	13.53585	1.38150
	prefers a familiar voice and heard an unfamiliar voice	106	75.3302	18.64185	1.81066
original_test_TRN_score	prefers a familiar voice and heard a familiar voice	96	77.5104	15.55296	1.58737
	prefers a familiar voice and heard an unfamiliar voice	106	70.1698	22.82416	2.21688

Independent Samples Test

		evene's Test fo uality of Varianc		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	g. (2-taile	Mean ifferenc	td. Erro ifferenc	Lower	Upper
cognitive_load_l	Equal varia assumed	.767	.382	-3.717	203	.000	-.94269	.25365	.44281	.44256
	Equal varia not assume			-3.707	98.801	.000	-.94269	.25429	.44413	.44124
cognitive_load_t	Equal varia assumed	2.032	.156	-3.147	200	.002	-.84768	.26937	.37886	.31650
	Equal varia not assume			-3.164	99.990	.002	-.84768	.26796	.37606	.31930
cognitive_load_t	Equal varia assumed	.613	.435	-.242	199	.809	-.06743	.27906	.61773	.48287
	Equal varia not assume			-.243	98.999	.808	-.06743	.27741	.61448	.47962
original_test_RE	Equal varia assumed	5.165	.024	2.145	200	.033	4.96148	2.31285	.40078	.52218
	Equal varia not assume			2.178	91.212	.031	4.96148	2.27750	.46923	.45373
original_test_TR	Equal varia assumed	9.368	.003	2.644	200	.009	7.34061	2.77667	.86531	.81590
	Equal varia not assume			2.692	86.178	.008	7.34061	2.72659	.96162	.71959

T-Test

Group Statistics

	groups_B_and_famili	N	Mean	Std. Deviation	Std. Error Mean
cognitive_load_learning	no preference and hea a familiar voice	69	4.0290	1.74871	.21052
	no preference and hea an unfamiliar voice	85	5.1647	1.64640	.17858
cognitive_load_test_RE	no preference and hea a familiar voice	69	4.7391	1.82831	.22010
	no preference and hea an unfamiliar voice	85	5.3176	2.10561	.22839
cognitive_load_test_TR	no preference and hea a familiar voice	69	6.0145	1.98889	.23943
	no preference and hea an unfamiliar voice	85	6.1529	1.88039	.20396
original_test_REC_scor	no preference and hea a familiar voice	69	81.9130	13.56871	1.63348
	no preference and hea an unfamiliar voice	85	79.0353	15.18963	1.64755
original_test_TRN_scor	no preference and hea a familiar voice	69	79.4348	14.60306	1.75800
	no preference and hea an unfamiliar voice	85	75.9176	19.79130	2.14667

Independent Samples Test

		Levene's Test for quality of Variance		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	ig. (2-tailed	Mean Difference	Std. Error Difference	Lower	Upper
cognitive_load_learr	Equal varianc assumed	2.785	.097	-4.140	152	.000	-1.13572	.27433	1.67770	-.59374
	Equal varianc not assumed			-4.114	141.683	.000	-1.13572	.27606	1.68145	-.58999
cognitive_load_test_	Equal varianc assumed	1.914	.169	-1.797	152	.074	-.57852	.32187	1.21443	.05740
	Equal varianc not assumed			-1.824	151.286	.070	-.57852	.31718	1.20520	.04816
cognitive_load_test_	Equal varianc assumed	.097	.756	-.443	152	.659	-.13845	.31269	-.75622	.47933
	Equal varianc not assumed			-.440	141.974	.660	-.13845	.31453	-.76021	.48331
original_test_REC_s	Equal varianc assumed	2.132	.146	1.226	152	.222	2.87775	2.34748	1.76016	7.51566
	Equal varianc not assumed			1.240	150.577	.217	2.87775	2.32006	1.70632	7.46182
original_test_TRN_s	Equal varianc assumed	2.851	.093	1.229	152	.221	3.51714	2.86160	2.13651	9.17079
	Equal varianc not assumed			1.268	150.714	.207	3.51714	2.77466	1.96512	8.99940

T-Test- learning efficiency and motivation on task indices in relation to students' preferences

Group Statistics

	groups_B_and_famili	N	Mean	Std. Deviation	Std. Error Mean
Learning_process_ efficiency_REC	prefers a familiar voice and heard a familiar voice	96	.1843	1.23198	.12574
	prefers a familiar voice and heard an unfamiliar voice	106	-.4028	1.35908	.13201
Learning_process_ efficiency_TRN	prefers a familiar voice and heard a familiar voice	96	.2017	1.15961	.11835
	prefers a familiar voice and heard an unfamiliar voice	106	-.4341	1.34147	.13030
Task_efficiency_REC	prefers a familiar voice and heard a familiar voice	96	.2096	1.15500	.11788
	prefers a familiar voice and heard an unfamiliar voice	106	-.3213	1.40155	.13613
Task_efficiency_TRN	prefers a familiar voice and heard a familiar voice	95	.0773	1.09980	.11284
	prefers a familiar voice and heard an unfamiliar voice	106	-.2367	1.28905	.12520
Three_dimensional_REC	prefers a familiar voice and heard a familiar voice	96	.2747	1.41299	.14421
	prefers a familiar voice and heard an unfamiliar voice	106	-.4536	1.54804	.15036
Three_dimensional_TRN	prefers a familiar voice and heard a familiar voice	95	.1751	1.34636	.13813
	prefers a familiar voice and heard an unfamiliar voice	106	-.3845	1.44471	.14032
Motivation_on_task_REC	prefers a familiar voice and heard a familiar voice	96	-.0946	.51741	.05281
	prefers a familiar voice and heard an unfamiliar voice	106	-.0158	.72074	.07000
Motivation_on_task_TRN	prefers a familiar voice and heard a familiar voice	95	.1020	.58768	.06029
	prefers a familiar voice and heard an unfamiliar voice	106	-.1630	.96466	.09370

Independent Samples Test

		evene's Test fc uality of Varianc		t-test for Equality of Means						
									)5% Confidence Interval of the Difference	
		F	Sig.	t	df	g. (2-taile	Mean)ifferenc	Std. Erro)ifferenc	Lower	Upper
Learning_proce efficiency_REC	Equal varia assumed	.114	.736	3.205	200	.002	.58710	.18320	22586	94835
	Equal varia not assum			3.220	)0.000	.001	.58710	.18231	22761	94659
Learning_proce efficiency_TRN	Equal varia assumed	1.403	.238	3.586	200	.000	.63579	.17729	28619	98540
	Equal varia not assum			3.612	)9.580	.000	.63579	.17602	28869	98290
Task_efficiency_	Equal varia assumed	4.254	.040	2.921	200	.004	.53098	.18180	17250	88947
	Equal varia not assum			2.949	)8.283	.004	.53098	.18008	17587	88609
Task_efficiency_	Equal varia assumed	1.339	.249	1.847	199	.066	.31401	.17001	02125	64927
	Equal varia not assum			1.863	)8.535	.064	.31401	.16855	01836	64638
Three_dimensic	Equal varia assumed	.795	.374	3.480	200	.001	.72833	.20928	31565	14102
	Equal varia not assum			3.496	)9.986	.001	.72833	.20834	31751	13916
Three_dimensic	Equal varia assumed	.404	.526	2.831	199	.005	.55956	.19767	16977	94936
	Equal varia not assum			2.842	)8.688	.005	.55956	.19690	17127	94785
Motivation_on_t	Equal varia assumed	2.532	.113	-.885	200	.377	-.07886	.08909	25455	09682
	Equal varia not assum			-.899	)0.367	.370	-.07886	.08769	25183	09410
Motivation_on_t	Equal varia assumed	12.109	.001	2.320	199	.021	.26505	.11427	03972	49038
	Equal varia not assum			2.379	76.214	.018	.26505	.11142	04516	48494

T-Test

Group Statistics

	groups_B_and_famili	N	Mean	Std. Deviation	Std. Error Mean
Learning_process_ efficiency_REC	no preference and hea a familiar voice	69	.4277	1.12557	.13550
	no preference and hea an unfamiliar voice	85	-.1411	1.12920	.12248
Learning_process_ efficiency_TRN	no preference and hea a familiar voice	69	.4432	1.02850	.12382
	no preference and hea an unfamiliar voice	85	-.1261	1.13902	.12354
Task_efficiency_REC	no preference and hea a familiar voice	69	.2387	1.17287	.14120
	no preference and hea an unfamiliar voice	85	-.1005	1.35349	.14681
Task_efficiency_TRN	no preference and hea a familiar voice	69	.1905	1.10996	.13362
	no preference and hea an unfamiliar voice	85	.0086	1.26635	.13736
Three_dimensional_RE	no preference and hea a familiar voice	69	.4368	1.32398	.15939
	no preference and hea an unfamiliar voice	85	-.1975	1.43188	.15531
Three_dimensional_TR	no preference and hea a familiar voice	69	.3974	1.23150	.14825
	no preference and hea an unfamiliar voice	85	-.1084	1.31276	.14239
Motivation_on_task_RE	no preference and hea a familiar voice	69	.0240	.50383	.06065
	no preference and hea an unfamiliar voice	85	.1010	.52287	.05671
Motivation_on_task_TR	no preference and hea a familiar voice	69	.1034	.63900	.07693
	no preference and hea an unfamiliar voice	85	.0220	.65267	.07079

Independent Samples Test

		evene's Test fo uality of Varian		t-test for Equality of Means						
									5% Confidence Interval of the Difference	
		F	Sig.	t	df	g. (2-taile	Mean ifferenc	td. Erro ifferenc	Lower	Upper
Learning_proce efficiency_REC	Equal vari assumed	.014	.906	3.113	152	.002	.56877	.18271	20779	92976
	Equal vari not assum			3.114	45.747	.002	.56877	.18265	20778	92976
Learning_proce efficiency_TRN	Equal vari assumed	.134	.714	3.220	152	.002	.56930	.17678	22003	91856
	Equal vari not assum			3.255	50.245	.001	.56930	.17491	22370	91490
Task_efficiency	Equal vari assumed	2.325	.129	1.641	152	.103	.33922	.20674	06924	74767
	Equal vari not assum			1.665	51.327	.098	.33922	.20369	06322	74166
Task_efficiency	Equal vari assumed	1.016	.315	.936	152	.351	.18191	.19427	20192	56573
	Equal vari not assum			.949	51.077	.344	.18191	.19163	19671	56053
Three_dimensic	Equal vari assumed	.253	.615	2.827	152	.005	.63432	.22437	19103	07760
	Equal vari not assum			2.850	49.400	.005	.63432	.22254	19458	07405
Three_dimensic	Equal vari assumed	.150	.699	2.445	152	.016	.50587	.20693	09703	91471
	Equal vari not assum			2.461	48.809	.015	.50587	.20556	09968	91206
Motivation_on_t	Equal vari assumed	.186	.667	-.923	152	.357	.07698	.08336	24168	08771
	Equal vari not assum			-.927	47.568	.355	.07698	.08304	24108	08711
Motivation_on_t	Equal vari assumed	.037	.848	.777	152	.439	.08138	.10477	12562	28838
	Equal vari not assum			.778	46.745	.438	.08138	.10454	12523	28798