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MOBILE LEARNING ADOPTION: TOWARDS A SEAMLESS LEARNING MODEL IN PRIVATE HIGHER EDUCATION IN TRINIDAD

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1332518/1

A thesis in partial fulfilment of the requirements of Anglia Ruskin University for the degree of
Doctor of Business Administration

Submitted: FEBRUARY 2021

Acknowledgments

The completion of this thesis and more so the journey would not have been truly fruitful without the valuable advice, encouragement, support and inspirational motivation of others.

Firstly, my gratitude to the President/Founder and the Directors of the private higher education institution for providing me with the opportunity to read for this research degree. I would also like to say thank you to my many students who have unknowingly at times provided the much needed impetus to complete this research.

My genuine appreciation must also be expressed to my doctoral supervisory team; Professor Gary Packham and Dr. Simon Evans. Your confidence in me and timely guidance under your mentorship allowed me to develop into the researcher I am today.

To my parents, I say thanks to my mom for her innate never ending love and support which has kept me humbled and grounded. To my dad, who endured a doctoral journey of his own to pave the way, you provided the inspiration and made it easier. I hold steadfast to your teaching regardless; I am my father's son.

Words cannot express my love and gratefulness to Anesah, your patience is beyond remarkable, your love is at times unspoken but is heard from a distance. Arianne and Liam my never ending source of reasoning and cosmic energy, I say to you that I can no longer say no! Together let's move onto the next journey!

ANGLIA RUSKIN UNIVERSITY

ABSTRACT

FACULTY OF BUSINESS AND LAW

DOCTOR OF BUSINESS ADMINISTRATION

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The research is set in the context of the private higher education sector in Trinidad, where adult learners predominantly study on a part time basis in a traditional classroom environment that utilize a teacher-centered approach.

Therefore, the main purpose of the study involved the generation of a mobile learning adoption model, as research into mobile learning is still in its infancy stage in developing countries like Trinidad. In so doing, the researcher sought to evaluate the motivational, pedagogical and constructivist mobile learning preferences as predictors of behavioural intention to adopt mobile learning. Thus, the research addressed gaps in the literature and the ongoing debate on the suitability of the Technology Adoption Model (TAM) to explain behavioural intention to adopt mobile learning by integrating the Uses Gratification Theory (UGT). The study was also able to shed light on the learning preferences of adult learners for a mobile learning environment.

The research was conducted under the interpretivist research paradigm which was implemented through an action research project, SL2G. An online questionnaire was administered to 345 students at a private higher education institution. The data was analysed using structural equation modelling to derive and validate the proposed model for mobile learning adoption.

The findings show that preference for a constructivist mobile learning environment and the pedagogical factors have the strongest effect on students' behavioural intention to adopt mobile learning, whereas the motivational factors were found to have a lower effect. The proposed model demonstrated the explanatory power of integrating TAM and UGT to predict the behavioural intentions of students to adopt mobile learning.

The findings from this research will be valuable to institutions and educators in developing countries as a guide for the effective integration of mobile learning and transformation to constructivist pedagogy.

Key Words: Mobile Learning Adoption, Behavioural Intention, Adult Learners, TAM, UGT, Constructivism, Trinidad.

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CHAPTER 1 INTRODUCTION

1.0 Introduction to Research Issue

The world today is truly globalized as a result of various information communication technology, none more relevant than mobile technology. Mobile technology has brought about changes to many areas of human existence; social interaction is now more than ever seamless and businesses operate on a timeless platform as customers can access their product or service 'on the go'. Moreover, mobile technology has impacted on several industries including banking, tourism and entertainment to name a few (Ozdamli and Uzunboylu 2014).

In recent years, mobile technology has been used in the education industry (Karimi 2016, pg. 769), this revolution was herald in with the advent of smartphones and tablet devices. In fact, smartphone usage has surpassed basic cellular usage since 2011/12 (Cochrane 2014). This is further exacerbated by eMarketer (2017) who suggested that in 2016 there were 3.26 billion mobile users worldwide, representing 44.6 % of the global population and further predicts that smartphone users worldwide will reach 4.14 billion by 2021 (see Figure 1.1 below).

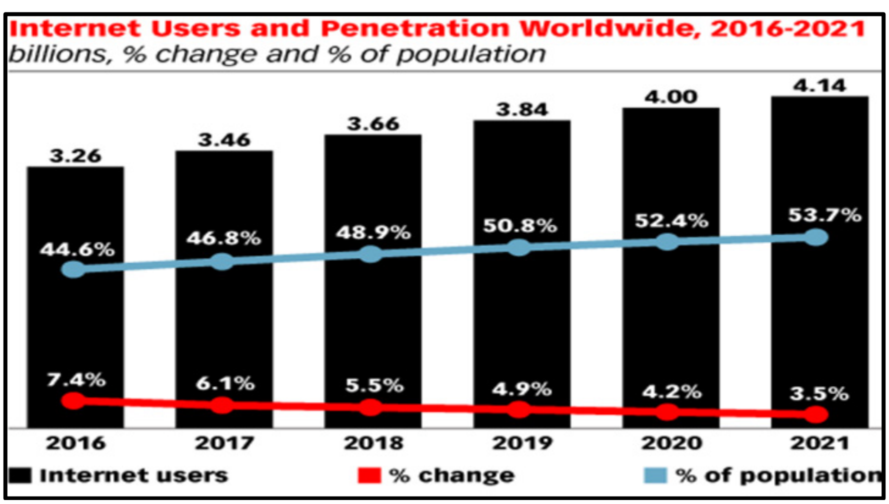

Figure 1.1 Smartphone Users and Penetration Worldwide 2015-2020
Source: eMarketer (2017)

Essentially, the education landscape from both student and lecturer viewpoints are changing as the trend towards digitizing gets a firmer grip on teaching and learning. This is expounded by statistics which shows that in the first quarter of 2020 there were 936 million mobile educational apps download (Clement 2020).

These advances in mobile technology have sparked interest from educators as it provides an opportunity to carry out learning activities in a ubiquitous manner. Mobile devices provide an opening for “learners to learn anywhere, at any time” (Ozdamli and Uzunboylu 2014, p.2; Karimi 2016, pg. 769). This is brought about by the various capabilities and solutions that are embedded in the devices, although as suggested by Seipold (2012) these capabilities were not intentionally designed for learning, but for everyday life. Therefore, as the rapid uptake and usage of mobile devices in daily life activities continues (Baydas and Yilmaz 2018), the challenge is to relate school and everyday life to each other, which involves, finding ways of using mobile technology for learning purposes (Seipold 2012).

Mobile devices, whether smartphone or tablets provide many functionalities that can be utilized by the education industry, for instance, e-book readers, office productivity including presentation apps, email, text messaging, mobile web browser and collaborative applications such as Twitter, Instagram and Facebook. Thus, from a purely technology perspective, these devices are fast becoming more capable of supporting the functions of teaching and learning from both student and teacher perspective (El-Hussein and Cronje 2010). This view is supported by Joo et al (2016, pg. 611) who stated that “the flexibility afforded by mobile devices makes learning portable and spontaneous; which allows students to experience more personalized learning, situated learning in a meaningful context”.

So, what exactly is mobile learning (m learning) and what does it promise and can it be used in the developing Caribbean country of Trinidad? The following sections of this chapter will seek to define and distinguish mobile learning from that of its parent, E Learning. In addition, it will be important to describe the functionality of mobile devices for teaching and learning in higher education. The chapter would also seek to establish the context for the case of mobile learning in Trinidad by analysing key indicators of readiness.

Lastly, the author intends to outline the purpose and intention of the research by specifying the desired research outcome for the higher education industry. As such, an overarching research question will be articulated with aligning objectives, which will bring about focus and specific research outcomes.

1.1 The evolution from Distance Learning to E Learning

In order to define and appreciate exactly what is meant by the term mobile learning, it is necessary to first explain its derivation and grand theoretical base, that of distance learning and E Learning. These modes of learning have emerged as a result of the convergence of technological and pedagogical developments since the 18^{th} century.

There has been a considerable pedagogical paradigm shift in the delivery of higher education based on the use ubiquitous and cost effective technologies. The main reason for this new paradigm is twofold: higher education providers have embraced the concept "that students should be actively engaged in sustainable communities of inquiry" (Garrison 2011, pg. 1) and the fact that learners require a flexible environment, who "want to be freed from the limits of time, place or pace of learning" (Brown 2003, pg. 3).

The evolution from distance learning to E Learning and now mobile learning coincides with the Industrial Revolution of the 18th to 19th centuries, the Internet Revolution of the 1980s and 1990's and the Mobile/Wireless Revolution of the last years of the 20th century and the early 21st century.

Distance learning was influenced by the industrial revolution which brought with it new means of transportation and communication. "It was no coincidence that the first trains, the first postal systems and the first correspondence courses commenced at the same time" as cited by Keegan (2005, pg. 6). Distance learning use technology to separate the learners from the teachers and the learners from the traditional classroom environment. This means that students using a distance learning mode are not studying in a University where the pedagogical approach is primarily instructor led and the interaction is automatic because of the face to face communication. Therefore, in distance learning the "technology is a critical element" (Bates 2005, pg. 5) as all communication is mediated through its use, but the approach to learning remained the same, that is, instructor led.

There is no doubt the concept of distance education has been around for quite some time, in fact according to Kaufman (1989 as cited by Bates 2005, pg. 6) there are three generations of distance learning. The first generation is characterised by one-way communication technology and often employed the use of a single technology that did not allowed student interaction and the mode of content delivery was print-based correspondence. The second generation, still largely one-way communication, introduced a multiple media approach where print-based correspondence was supplemented by multimedia such as CD-ROM that contained audio and video. These two generations relied heavily on the pedagogical approach of cognitive-behaviourist (Anderson and Dron 2012), that is, instructor led teaching and independent learning, where learning materials are pre-packaged and distributed to a mass of students, essentially maintaining one to many relationships.

The third generation is characterised by two-way interaction between the education provider and the learner and more importantly the amongst the learner community (Bates 2005). This two-way communication is mainly driven today by the use of the Internet more specifically the World Wide Web (WWW) which essentially herald the birth of E Learning.

According to Mayer (2017) E Learning plays an important role in higher education as it makes learning available anywhere. E Learning is formally defined as "electronically mediated asynchronous and synchronous communication for the purpose of constructing and confirming knowledge" (Garrison 2011, pg. 2). Furthermore, Clark and Mayer (2017) defined E Learning as the delivery of instructions to support individual learning using digital devices. Simply stated, E Learning involves delivering education electronically, therefore, it means using any form of electronic media such as the internet, intranet, extranet and associated communication technologies. It is more narrowly defined than distance learning which is mainly characterised by written correspondence.

It can be said that E Learning, while it has its genesis in distance education, represents a paradigm shift from cognitive-behaviourists model to a constructivist approach and then later to social-constructivism. This new paradigm is achieved by integrating independent learning and interaction through two-way communication that is not bounded by time and space. Essentially, as elucidated by Garrison (2011, pg. 4) "E Learning transform education in ways that extend beyond efficient delivery" and is distinguished from traditional education and distance learning because of the connectivity amongst learners.

The Distance Learning and pedagogical evolution discussed above is summarized in Figure 1.2 below. It can be seen that distance learning has evolved from the print and postal system to a model that use ubiquitous and cost effective technologies to deliver highly interactive learning experience which is not bounded by time and place.

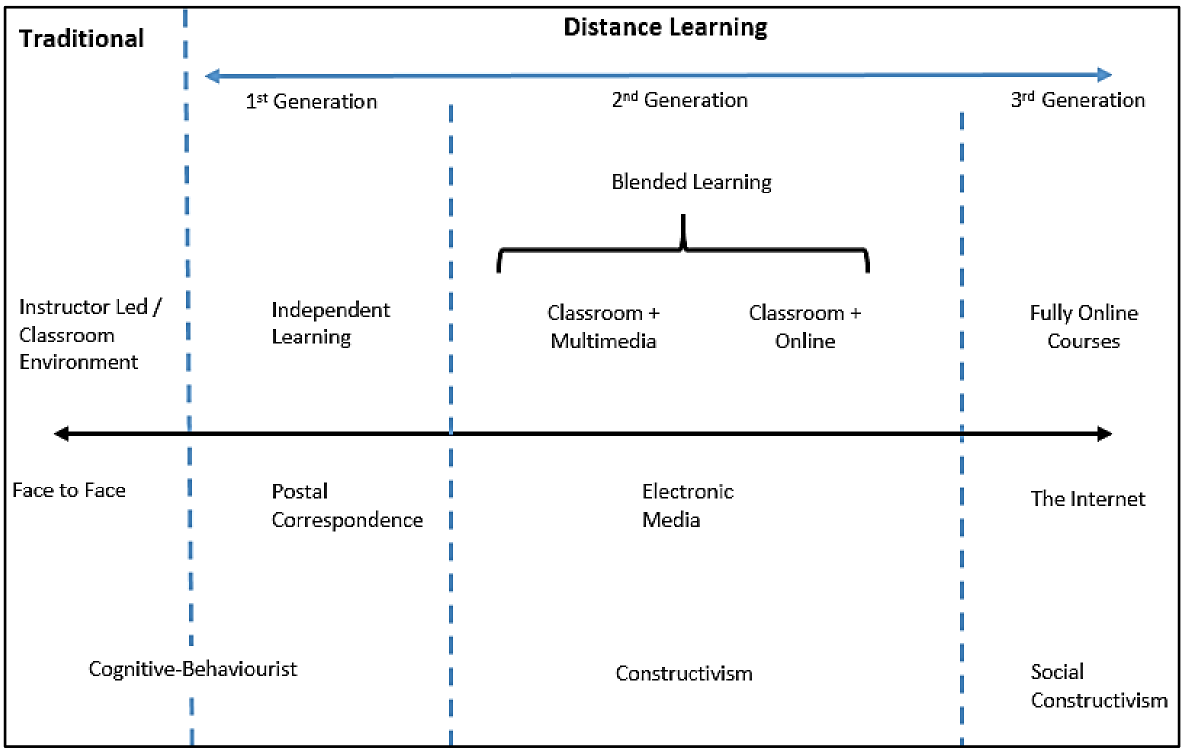

Figure 1.2 Evolution of Distance Learning to E Learning
Researcher (2014)

1.2 Defining M Learning

So where does mobile learning fit into this evolution? Mobile learning can be thought of a new stage or natural evolution of distance and E Learning (Georgiev et al 2004). Indeed, Thongsri et al (2018, pg. 279) suggests that "mobile learning has been extended from e-learning and it has become a part of distance learning". In fact, it is even more refined than E Learning since mobile learning combines the concept of E Learning with mobile computing (Behera 2013). Since the communication between the education provider and the learner is mediated via a mobile device that is connected to the internet. Furthermore, Karimi (2016, pg. 769) concurs with this view, defining mobile learning as “e-learning using mobile devices”. Essentially, mobile learning utilizes mobile computing devices such as tablets and smartphones as opposed to personal computers used by E Learning, this can be seen in Figure 1.3 below.

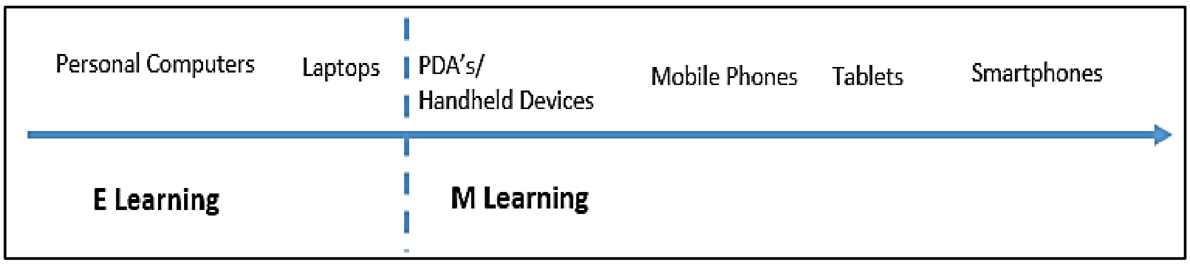

Figure 1.3 Device and E Learning Evolution
Researcher (2014)

Moreover, according to Park, Nam and Cha (2012, pg. 592), “M Learning is a new and independent part of e-learning where the education content is handled solely by mobile technology devices.”

Although there is a contrast with regards to the specific technology used, there is some similarity between the two concepts. As stated by Quinn (2001, pg.1) “M learning is a subset of E Learning” as seen in Figure 1.4 below. Additionally, mobile learning extends the flexibility and convenience of learning (Motiwalla 2007) as it breaks the barriers of time, place and space due to the ubiquitous nature of mobile technology. Further to this Motiwalla (2007, pg. 594) suggest that the “adult learner can minimise their unproductive time which may enhance their work-life-education balance”. Life-long learning speaks to ‘learn as you earn’, with mobile learning, life-long learners would be able to ‘learn as you earn on the go’.

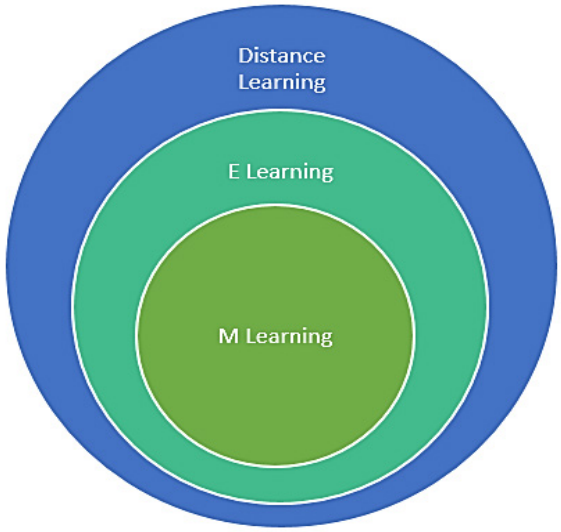

Figure 1.4 Relationship of Learning Paradigms
Source: Georgiev et al (2004) and So (2010)

In addition, as suggested by Karimi (2016) “mobile learning can also be individualized and adopted differently based on the needs of learners, making the learning process more efficient and effective”. Moreover, Hsia (2016) expounded that mobile learning affords the learner a highly interactive, flexible, and personalized learning environment.

The increased flexibility is due to the mobility of the functions that can be performed by these devices. Can you imagine a day in your life without a smartphone? These functions are vast and ever increasing as the technology matures and innovates, where the major functions include communication, utilities, entertainment and productivity. This can be seen in Figure 1.5 below, which shows the ecology of mobile device functions. The question to be considered is how can these functions and features be used from an education standpoint to enhance teaching and learning? What are the implications for the current pedagogical practice?

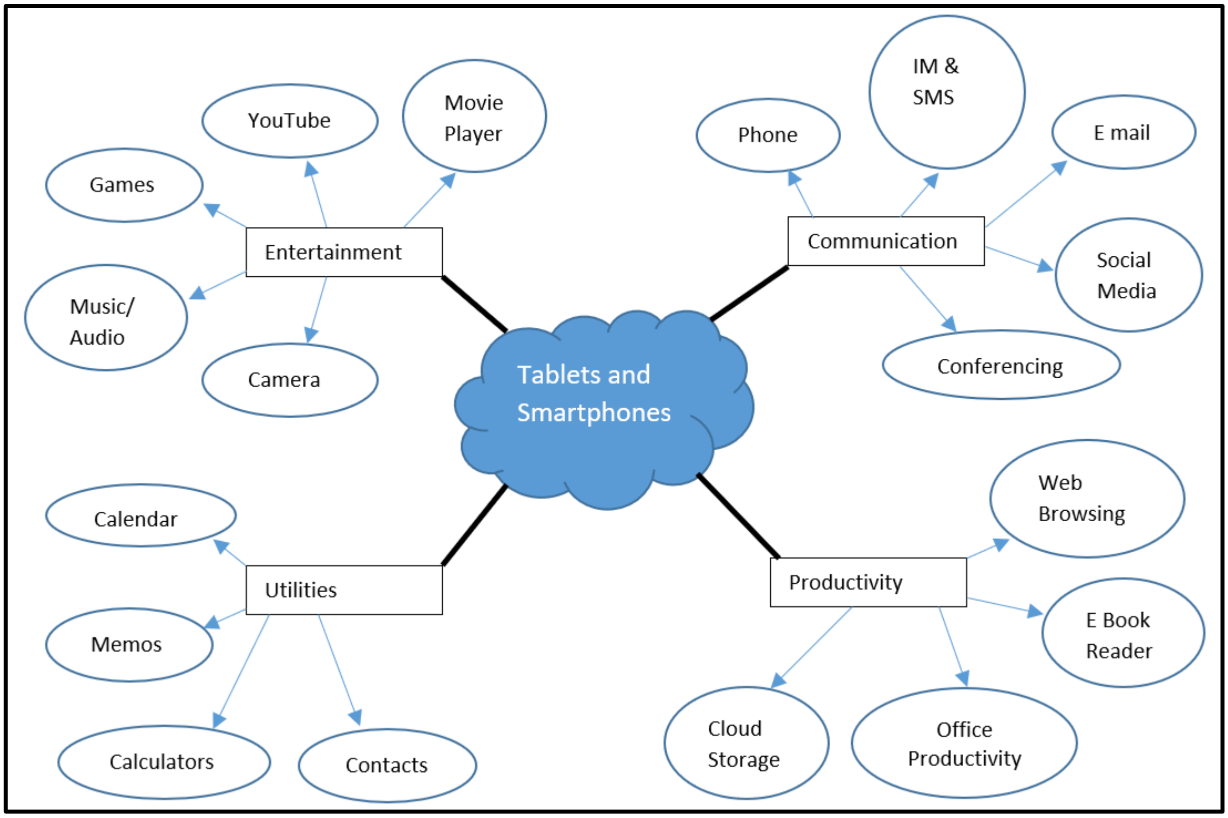

Figure 1.5 Smartphone and Tablet Ecology
Researcher (2014)

The manner in which mobile technologies are adopted and used in education, is determined to a large extent on "the conceptions of teaching held by teachers and trainers and the styles of learners" (Kukulska-Hume and Traxler 2005).

Indeed, different education fields and different teachers would have varying views and approaches (Kember 1997) as to what constitute the right style of teaching. Traxler (2007) purports that from a 'purist' perspective "mobile learning will support a wide variety of conceptions of teaching". There are two extremes teaching styles; didactic and discursive or as previously discussed cognitive-behaviourist and social constructivist. Generally, teachers and lecturers would fall somewhere between these two extremes. It can be argued that currently, sufficient mobile technologies exist that can support either extreme or a pragmatist, as can be seen in Figure 1.5 above. For instance, mobile version websites or a mobile application can be created to transmit content which would be accessed via a smartphone's web browser or installed app. Email can also be used to push content to students. Social media such as Twitter and Facebook, blogs and forums can all be accessed via tablets and smartphones which would support the discursive or social constructivist approach were students can create content and knowledge and the student becomes the teacher and the teacher becomes the student in some cases.

Student expectation of learning and how they want to learn will also determine what mobile learning technology can be used and how it will be used. This is an area of much contention, but as Traxler (2007) suggest mobile learning can fit the various learning styles of different students.

What is clear from the above is that there is an opportunity for mobile learning technologies to be applied to any teaching and learning style, but getting it right and creating sustainability is important. The education providers must understand their approach to teaching and the student learning needs, then determine the best suited mobile technology that would augment the pedagogical approach in the right manner (Kukulska-Hume and Traxler 2005). Also, Motiwalla (2007) suggest that in order to benefit from mobile learning educators must "learn how to apply appropriate pedagogies". This is critical as research has shown that incorporating learners' learning styles and preferences when developing new learning environments have resulted in positive outcomes (Tsai et al 2012; Tortorella and Graf 2017). However, although there is much interest in exploring this opportunity that mobile learning technologies present to educators, "mobile learning pedagogy in higher education is in an embryonic stage and its theoretical foundations have not yet matured" (Joo et al 2016, pg. 613).

In summarizing this section, it is a clear that the convergence of technological and pedagogical developments is creating an opportunity for innovations in higher education. The question now is "Why all the 'fuss' about mobile learning, it's only an evolution of E Learning, an area that have been well researched and documented in the educational literature for the past 20 years? But more importantly; why mobile learning in Trinidad? Why is it an issue or opportunity now for higher education providers in Trinidad? Why is it not a case of copying the best practice of the developed countries and world leading distance learning institutions?

Part of the answer lies in the contextualization of Trinidad, that is, the mobile environment and cultural diversity of developing countries is far different from that of developed countries where mobile learning "has been predicated on massive, static, and stable resources" (Traxler 2007). This is supported by Kaliisa, Palmer and Miller (2019) who found that country and cultural background is a significant determinant of mobile learning adoption and recommended that educators consider socio-cultural differences when designing mobile learning environments. Furthermore, whilst Khan et al (2019) acknowledge the view that online learning can narrow the educational gap created between urban and rural environments, the limitations of proper access to and usage of the information technology infrastructure erodes the potential for making the learning experience equitable in developing countries. This means that a prescriptive approach, which can work in developed countries, must be guarded against in developing countries (Traxler and Kukulska-Hulme, 2005) such as Trinidad. Since the evolution of E

Learning may take a trajectory that is very different from that in developed countries (Traxler 2007).

To gain an insight into Trinidad's mobile infrastructure and usage, the following section evaluated the degree of mobility and the potential target market for mobile learning.

1.3 Mobility in Trinidad and Tobago

The statistics of mobile usage is a good indicator of the potential for mobile learning adoption. Mobile technology adoption in Trinidad and Tobago has increased exponentially in the last ten (10) years, with annual subscriptions in 2011 increasing by some 700% when compared to 2001 (TATT 2013). Over the 5-year period from 2015 to 2019 there has been a small increase of 2% subscription rate (see Figure 1.6 below), moving from 2.12 million subscribers to 2.16 million subscribers in 2019.

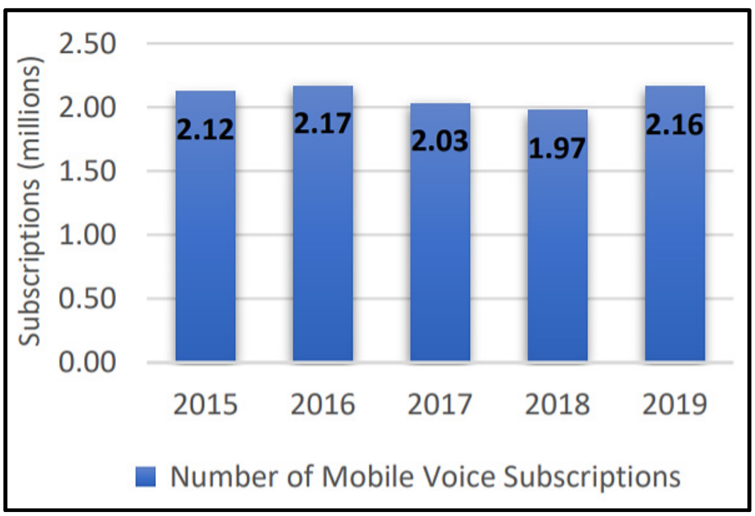

Figure 1.6 Mobile Subscriptions 2015-2019
Source: TATT (2020)

This is further expounded by the mobile penetration rate of 138.6 per 100 inhabitants in 2011 (TATT 2016) which increased by 13.5% to 157.3 in 2015 (TATT 2020), which is the highest rate among CARICOM countries (TATT 2016). This growth has plateaued over the period 2015 to 2019 as seen in Figure 1.7 below.

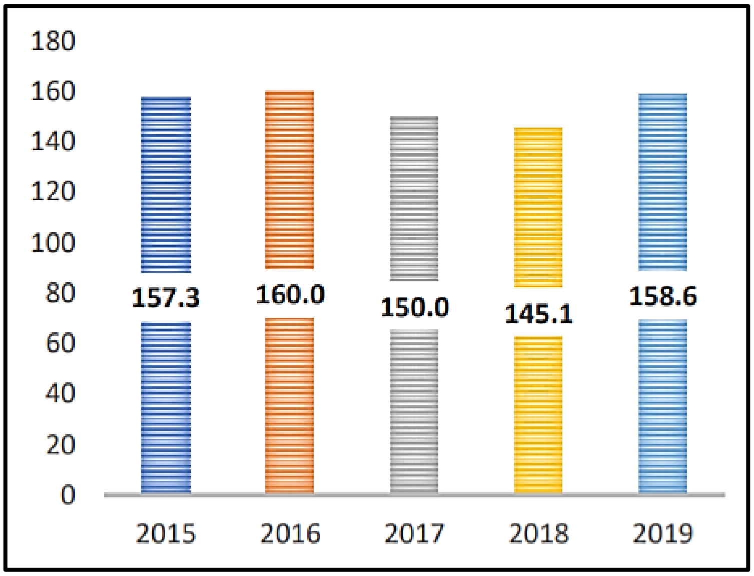

Figure 1.7 Mobile Penetration Rate 2015-2019
Source TATT (2020)

The mobile penetration rate essentially tells a story of total number of mobile subscription per capita, so essentially on an individual basis a person may have 1 or up to 2 subscriptions. This basically means that 100% of the population of Trinidad and Tobago owns at least one mobile phone.

How much time do they spend on their mobile phone? is another key indicator for mobile learning potential. For the period 2015 to 2019 domestic mobile voice traffic decreased from 3.91 to 2.75 billion minutes (TATT 2016; TATT 2020), this represents a significant decrease of 30%.

Perhaps the most important indicator of mobile learning adoption is access to mobile internet on smart mobile devices. In 2012, service providers introduced 4G networks, which promised broadband speeds via mobile handsets, this was a significant advancement to the current 2G technology. However, the uptake of the 4G mobile internet was slow and only represented 17.9% of total mobile internet subscriptions for 2012 (TATT 2013), this was mainly due to the cost of access.

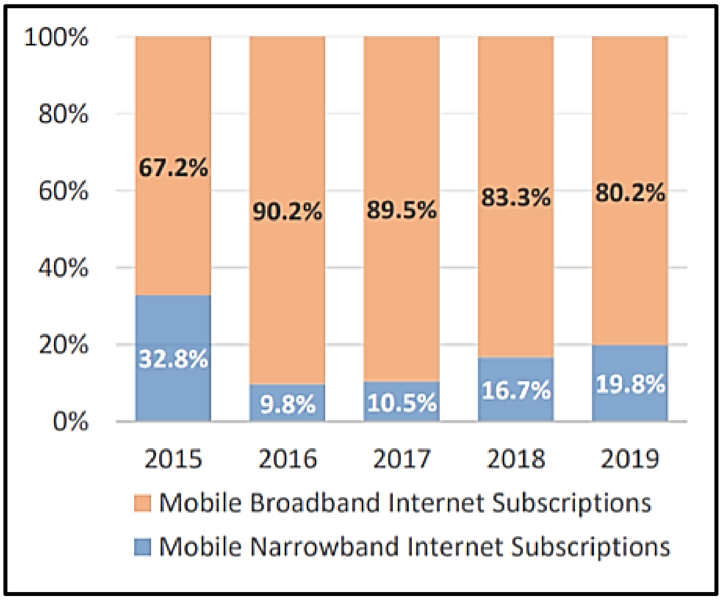

Figure 1.8 Percentage of mobile narrowband and broadband Internet subscriptions from 2015 to 2019
Source: TATT (2020)

This has since changed; whereby Mobile broadband internet access now represents 67% of the internet usage in 2015 and increased to 80% in 2019 as seen in Figure 1.8 above (TATT 2020).

Overall, in 2015, 40% or 645.4 thousand mobile internet subscribers had access to the internet on their mobile device, this represented a 13% increase from 2014 (TATT 2016). In the past five years mobile internet subscribers peaked at 707,300 in 2016 and decreased to 653,300 in 2019 (TATT 2020).

There is also a key difference to take notice of, mobile internet penetration has outstripped fixed internet penetration rate in the last 5 years, with mobile internet penetration rate of 47.9% in 2019 accounting for almost twice the fixed internet penetration rate of 24.9% in 2019 (see Figure 1.9 below).

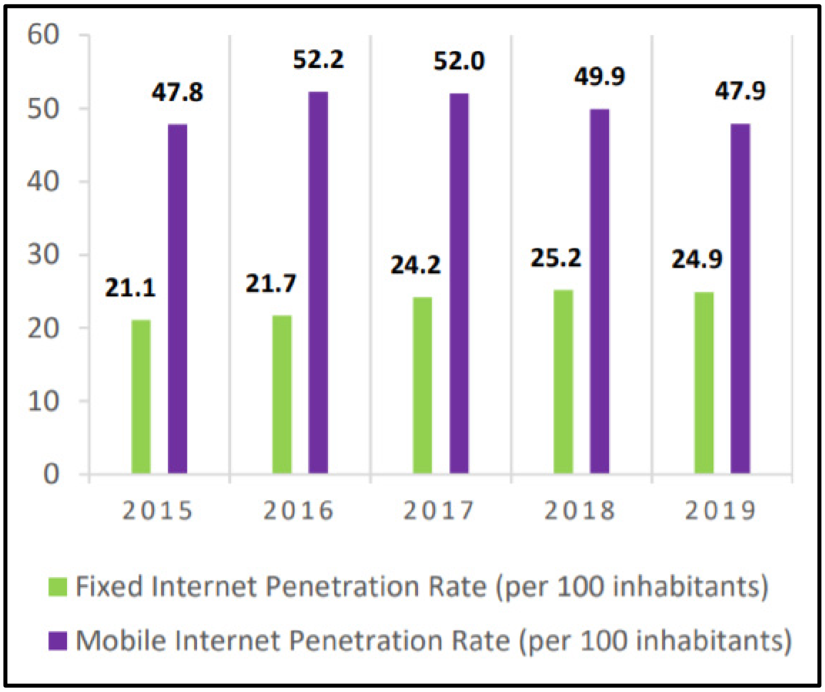

Figure 1.9 Fixed and Mobile Internet Penetration Rate 2015-2019
Source: TATT (2020)

What is the cause for this paradigm shift in internet subscription? Why has mobile internet access outnumbered fixed internet access from 2015 to 2019? Does this represent a new era, an era of mobile commerce and by extension mobile learning readiness in Trinidad?

One thing is for sure, the statistics digested above indicates that there is potential for mobile learning adoption, as the population of Trinidad as a whole are ‘M ready’. However, there is a need to drill down further into the background and student demographics of the higher education sector in order to gain an insight as to if and who can be targeted for mobile learning.

1.4 Higher Education in Trinidad

The research focused on the adoption of mobile learning in Trinidad by adult learners in the private sector of the higher education industry. Therefore, the review of student demographic in the tertiary sector focused on identifying the potential size of the adult learner segment.

Over the last 10 years the tertiary sector has mushroomed due to the Government Funding for students to undertake Undergraduate and Postgraduate studies. As reported by the Ministry of Science Technology and Tertiary Education (MSTTE) baseline tertiary education report in 2010, in the academic year 2008-2009 there were 54,363 students enrolled in both private and public institutions (MSTTE 2010). For this academic year full time enrolment accounted for 45.24% or 24,595 students while part time enrolment accounted for 54.76% or 29,768 students. For the academic year 2009-2010 there was an increase in full time enrolment by 8.41% however, part time enrolment significantly decreased by 12.8% when compared to the previous year (see Table 1.1 below).

	2008-2009	**2009-2010**	**% Change**
Full Time	24,595 (45.24%)	26,663 (49.33%)	**8.41%**
Part Time	29,768 (54.76%)	25,957 (50.67%)	**-12.8%**
Total enrolment by academic year	**54,363**	**52,620**	**-3.21%**

Table 1.1 Student Enrolment by Time Option 2008-2010
Source MSTTE (2010)

The ownership of tertiary institution is heavily skewed towards the private sector as seen in Figure 1.10 below, accounting for 96% of the institutions.

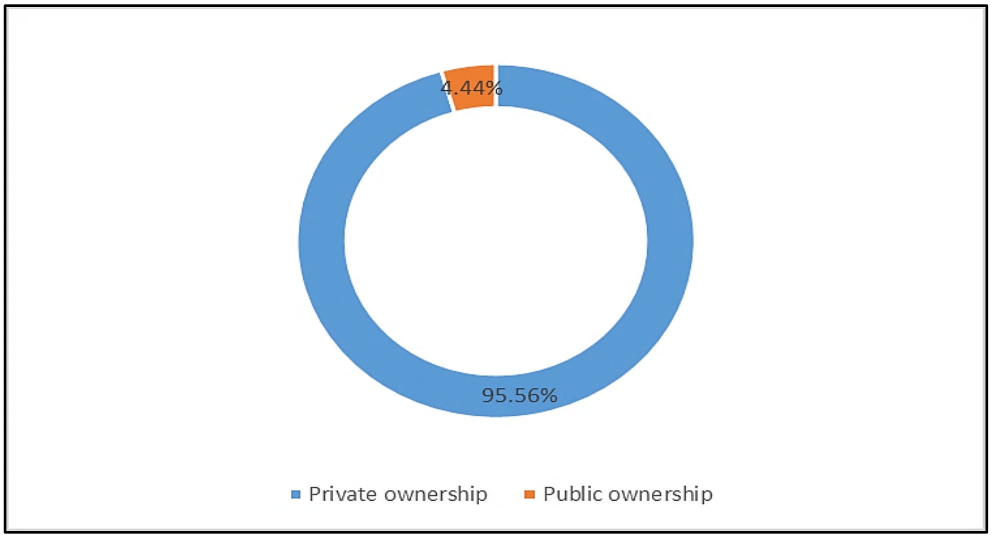

Figure 1.10 Ownership of Tertiary Institutions 2009-2010
Source: MSTTE (2010)

Further examination of the data reveals that the public institutions predominantly enrol full time students while private institutions predominantly enrol part time student. This can be seen from Figure 1.11 below, where 58.2% and 57.7% of part time students for the academic years 2008-2009 and 2009-2010 respectively enrolled in private institutions. Conversely, 67.5% and 74.6% of full time students enrolled in public institutions in 2008-2009 and 2009-2010 respectively.

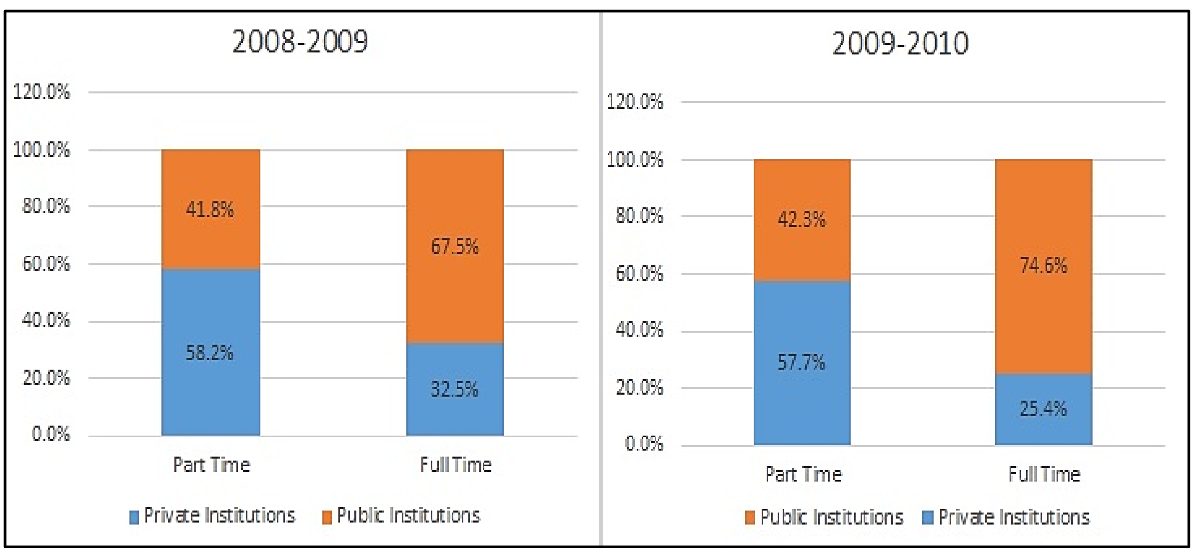

Figure 1.11 Part Time and Full Time Enrolment by Institution 2008-2010
Source: MSTTE (2010)

From the statistics presented above, it can be concluded that private sector tertiary institutions principally attract the part time students. Given that the researcher is limiting the study to adult learners, part time enrolment in private institutions is of significance as it means that these students who are usually life-long learners, have work-life-education balance issues (Hashim, Tan and Rashid 2014) and as suggested by Katz et al (1999) adult learners are usually working either full time or part time.

It was also useful to look at the entry route into tertiary education, this gave an indication of the potential of mobile learning adoption. The majority of students entering higher education for the first time in the academic year 2009-2010 possessed CSEC or GCE 'O' Levels (50%), while the second largest category of entrants (25.52%) to the sector were those possessing mature or professional experience (MSTTE 2010). This represents two type of students, young adults entering from secondary schools and adults who are re-entering education. The mature entry students are more inclined to learn based on a constructivist pedagogy as they are working either full time or part time and generally have a rich set of work experience.

The age distribution is also important to consider since M Learning adoption may vary based on age (Wang, Wu and Wang 2009). For the academic year 2008-2009 and 2009-2010 the age group 20-29 accounted for the largest segment of 55.4% and 53.41% respectively (MSTTE 2010). This means that adults account for a significant proportion of students for the respective academic years mentioned above.

At this point it is important to define adult learners to bring relevance and context to the above discussion.

1.5 Defining Adult Learners

For the purpose of this research adult learners were defined as students who are older than students who traditionally enter tertiary education right after secondary school, that is, through natural matriculation. In other words, adult learners are typically over 21 years (Katz et al 1999 as cited by Hashim et al 2014).

Adult learners are significantly different from traditional learners (< 21 years), as they are self-motivated, have a clear sense of direction and clearly understand their educational goals. They also exhibit a preference for a constructivist learning style as they are aided by work experience, reflections and actions (Hashim et al 2014). It is therefore important to understand their needs and adoption influencers in using mobile learning so that higher education providers in Trinidad can develop the right teaching and learning strategy by implementing mobile technology that would not be resisted by these adult learners.

The adult learner population is being used for this research since they are typically technological non-conversant at some point and face challenges using online learning systems. Prensky (2001a) classify these type of learners as digital immigrants, those who were not born in the digital age of the mid 1990's. They have to learn and adapt to technologies rather than seeing them as a natural tool. Unlike the immigrants, the digital natives speak the digital language as they were 'born on the net', they are often referred to as Net Gens (Prensky 2001a). These digital native students have developed new approaches to learning and are more inclined to learn via interaction, collaboration and they want information and knowledge now and 'on the go' (Prensky 2010 and Tapscott 2009).

On the other side, digital immigrants' adoption of technology is not automatic and cannot be assumed that once they adapt to it, they are technological savvy, since they may still encounter challenges from a both technological and motivational, social attitude perspective. Further, Prensky (2010) and Tapscott (2009) argue it is the digital natives that are forcing the paradigm shift in education to social constructivism pedagogy, but it is important to view the change from the viewpoint of the digital immigrants as well.

Digital immigrants while they may be familiar with instructor-led pedagogy, their adoption of the mobile technology will indeed create a transitionary need for and to social constructivism pedagogy. This means that their learning needs will be different from those of the digital age as they are not faced with the transition paradox.

Having considered the definition of adult learners and the demographics above, there is no doubt that the adult learners' segment in the tertiary education sector is significant, as their learning needs are vastly different and they are technology challenged.

1.6 Context of the Study

In the higher education sector in Trinidad, private institutions outnumber public institutions as discussed above, however many of the private institutions are categorised by the MSTTE as either small or medium, only five (5) private schools have been categorised as large by MSTTE (2010). The public institutions while they are outnumbered, attract a larger population of students in comparison to their rival private sector.

The private sector model is shaped by traditional distance learning. Currently, private sector institutions are not accredited as awarding bodies by the Accreditation Council of Trinidad and

Tobago (ACTT). As such they partner with foreign universities mainly from the United Kingdom (UK) to deliver the tuition on-behalf of the UK Partners, with whom the students are registered.

Students who attend private institutions receive local tuition in a traditional classroom environment and there is little or no online support for learning by the local institutions. Instead, students are given access to the University's E Learning environment, which affords the students the opportunity to interact with additional course content and learning materials online. To put it into perspective, local students benefit from blended learning as defined by Vaughan, Cleveland-Innes and Garrison (2013) as their education experience includes both access to the web-based learning content and activities provided by the foreign university and the face-to-face traditional classroom learning activities provided by the private institution locally, as shown in Figure 1.12 below. This view of blending learning is also supported by MacDonald (2017) who suggested that blending learning involves the introduction of online media to a course whilst maintaining the traditional offline approaches to teaching and learning. Moreover, Laurillard (2014) extended this view by advocating that blended learning as the means to achieving education for the 21st century through the "thoughtful integration of integration of conventional and digital methods of teaching and learning".

In the context of blended learning, the model below indicates that there is a gap in the application of blended learning, as the local private tertiary institutions do not provide any significant online learning opportunity for students as they predominantly use the instructor-led, cognitive pedagogy, which is not compatible with to today's digital natives and digital immigrants who have adapted to various technology.

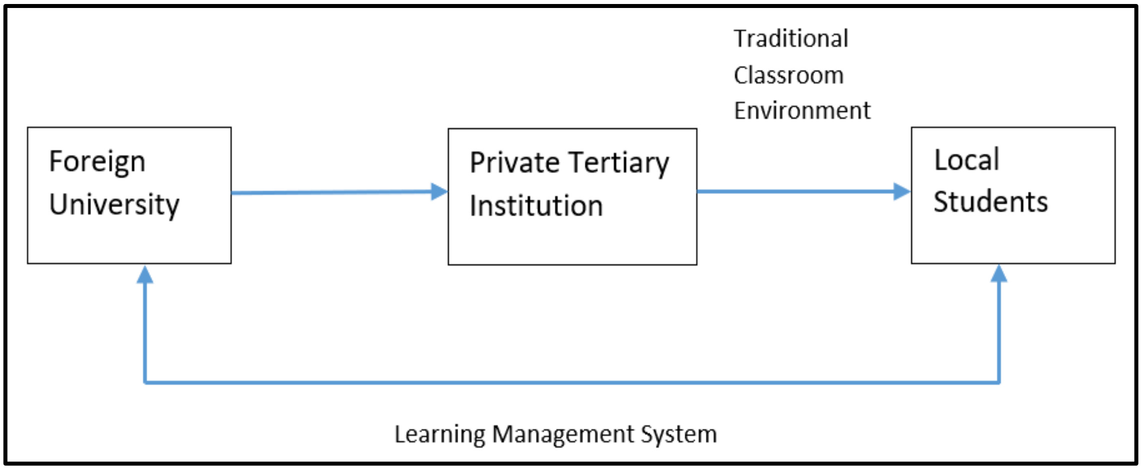

Figure 1.12 Basic Private Tertiary Institution Business Model
Researcher (2014)

These local institutions need to find ways of enhancing the learning experience of students by meeting their need for a knowledge based education. Furthermore, there is an opportunity to extend the learning process outside of the traditional classroom. When this is considered with the student demographics discussed above, which demonstrates that a large proportion of learners are adults and are enrolled on a part time basis, the concept of informal learning becomes relevant.

This is where mobile learning can be useful to higher education providers since it negates the time and space factor of learning and it can be used to enhance the current instructor-led pedagogy or change it to a constructivist approach. In addition, "students want a mobile-friendly LMS experience and highly personalized guidance for meaningful learning on their handheld mobile device" (Joo et al 2016, pg. 612). So what is informal learning and how can mobile technology be used to provide such opportunities?

Informal learning was brought to the limelight first by Tough (1971) and then Livingstone (2001). According to Tough (1971) informal learning "is simply a major, highly deliberate effort to gain certain knowledge and skill" while Livingston (2001, pg. 4) defined informal learning as "any activity involving the pursuit of understanding, knowledge or skill which occurs outside the curricula of institutions providing educational programs, courses or workshops". Initially, these insights did not distinguish whether informal learning could be intentional or unintentional which is not recognized by the learner (Naismith et al 2004). With this in mind Livingston reworked his definition of informal learning to include "that unintentional or tacit informal learning has been relatively underestimated or ignored" (Clough et al 2008, pg. 360). Further to this, Eraut (2000) classified informal learning using a continuum of the learner's intent from deliberate learning to implicit learning, while reactive learning was thought to be in the middle of both extremes (see Figure 1.13 below).

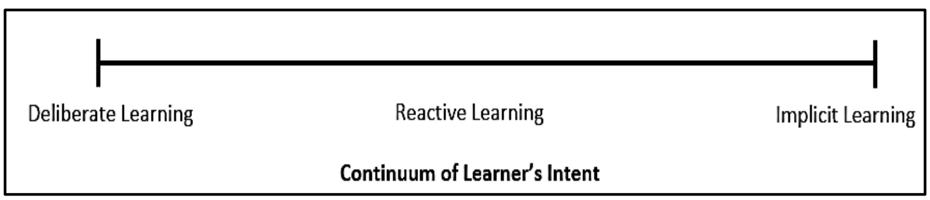

Figure 1.13 Classification of Informal Learning
Adapted from Eraut (2000)

This idea has been extended further by Vavoula et al (2005) who categorized learning based on whether the process and the goals of learning were defined or unspecified and by whom, the learner or teacher (see Figure 1.14 below).

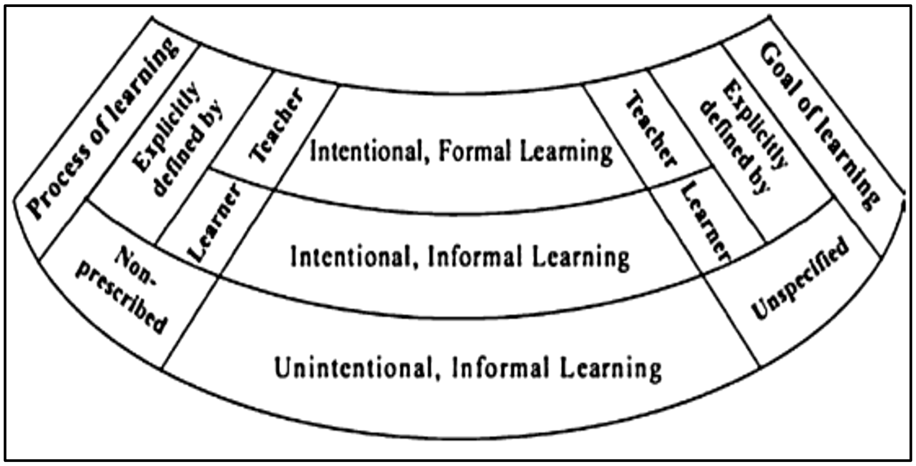

Figure 1.14 Typology of Informal Learning
Source: Vavoula et al (2005)

Vavoula's et al (2005) typology distinguishes between formal and informal learning; in addition, the model includes the classification made by Livingston (2006) that informal learning can be both intentional and/or unintentional.

Further to this, Vavoula's typology subdivides the intentionality domain, into two areas of control: 1. Control over the process of learning, that is, the tools and methods used to learn and 2. Control over the goals of learning. However, the model does not speak of the "types of learning process choices that a learner or teacher may make" (Clough et al 2008, pg.361).

The question now is Can mobile technology provide the tools and methods that will support intentional informal learning? Kukulska-Hulme and Traxler (2013, pg. 250) firmly takes the stance that "mobile technologies are highly suited to learning that has variously been described as informal, opportunistic and spontaneous".

Given that students spend more time in the informal learning space (Looi et al 2010), that is, in their work environment and engaging in social life activities. There is an opportunity to exploit this space as seen in Figure 1.15 below, which shows the learning environment of private higher education institutions. Kukulska-Hulme and Traxler (2013, pg. 248) propose that mobile technology can support a "learners' wider social and economic contexts".

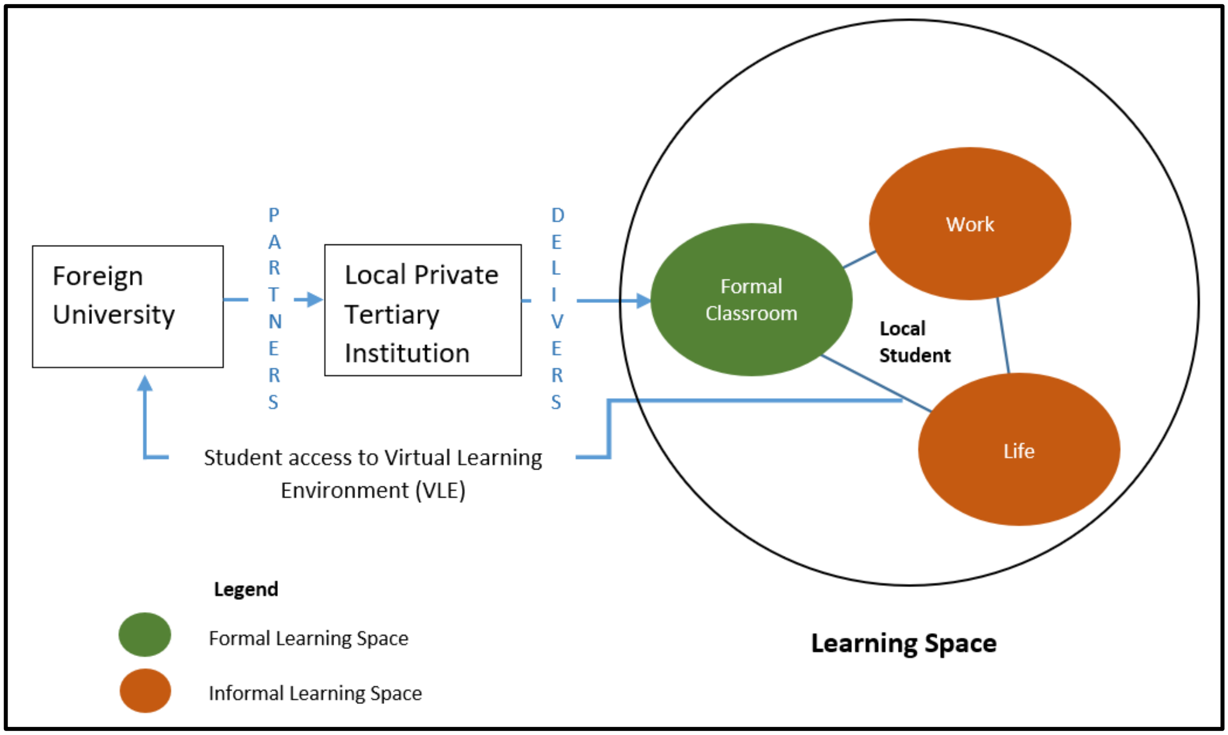

Figure 1.15 Learning Environment for Private Tertiary Institution
Researcher (2014)

Mobile technology also challenges a longstanding learning praxis that there is a traditional dichotomous distinction between formal learning and informal learning environments. Looi et al (2010) believes that "the two forms of learning should not be seen as dichotomous and conflicting situations". Through the affordances of mobile technology, that gap should be bridged by creating a Seamless Learning Environment which stimulates an integrated and synergetic effect on higher education. In essence, learning should become more flexible with no mode, time, place and pace boundaries.

So, is there a need rethink pedagogy in the mobile age? Should pedagogical approaches change to adapt to the changing technology? Or should pedagogy dictate what technologies can be used? What is certain is that "technologies may change, but the innovations in pedagogy bring lasting benefits" (Sharples, et al 2013).

1.7 Current M Learning Practice

Mobile learning has grown significantly in last decade and has raised a lot of attention from practitioners and academics. This section will provide insights on the level of mobile learning activities both from a global perspective and from the researchers' current practice as an educator.

There are numerous amounts of workshops, seminars and conferences being held globally. The MLEARN series was the first main conference to be held in 2002 and is now in its 19th year. In addition, there was an International Workshop on Mobile and Wireless Technologies in Education in 2002 sponsored by Institute of Electrical and Electronics Engineers (IEEE). Furthermore, The United Nations Educational Scientific Cultural Organization (UNESCO) held a conference in February 2014, at which there were more than 700 participants from over 60 countries. Moreover, in 2012 UNESCO initiated a working paper series on mobile learning.

There have also been several landmark project and publications in the past, some legacy project includes MoLeNet project in the UK and Mobile Oxford, UNESCO (2012b). Also, according to the London Mobile Learning Group (2014) project database, several projects have been completed in Europe including:

1. SoMobNet - Social Mobile Network to enhance community building for adults' informal learning (2011-2012)
2. mLeMan (2010-2012)
3. MyMobile - Education on the move. Responsive learning contexts in European Adult Education (2010-2012)

More recently, UNESCO embarked on a 5-year project in 2016 to derive the best practices in mobile learning based on initiatives implemented by governments, ministries of education and schools from many countries, including; Spain, Finland, Croatia, United Kingdom and Portugal (UNESCO 2019). In addition, universities across the European Union have engaged in a mobile learning for lifelong learning through the Mobile Technologies in Lifelong Learning (MOTILL) project (Arrigo et al 2013).

There are also many special issues in journals such as the Journal of Computer Assisted Learning, International Journal of Mobile Learning and Organisation, International Journal of Mobile and Blended Learning, Journal on Research and Practice in Technology Enhanced Learning, International Journal of Interactive Mobile Technologies and the magazine e-learning as outlined by Frohberg et al (2009).

In the last 10 years research into mobile learning adoption have started to emerge as a mainstream area of concern. According to Kumar and Chand (2019) there was an increase in the number of journal articles being published each year for the period 2009 to 2017. Furthermore, Kumar and Chand (2019, pg. 477) based on their systematic review of publications, concluded that research in this field is growing and as such additional research articles will emerge in the future.

Despite the plethora of mobile learning research projects being implemented in a developed and developing country contexts, the integration of mobile learning into higher education remains "at an experimental stage with students using mobile devices in pedagogically limited ways" (Kaliisa, Palmer and Miller 2019, pg. 558).

In addition, the researcher is an active practitioner in higher education for the past sixteen (16) years and have used blended learning for the past eight (9) years by creating a learning website http://www.samuellearning.org for students to access learning materials. Analytics from the website for the academic year September 2016 to May 2017 showed that there were 29,769 page views (see Figure 1.16 below).

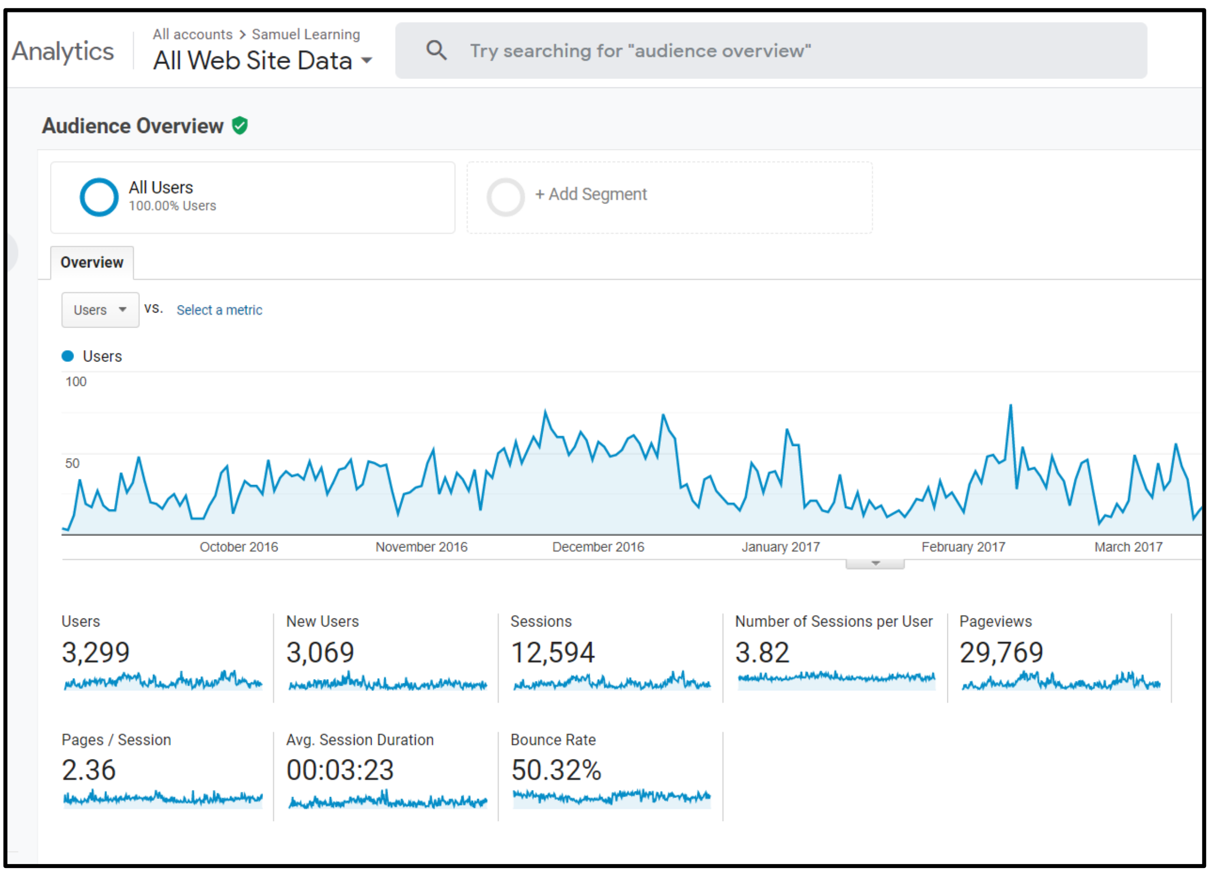

Figure 1.16 Samuellearning.org Page views 2016-17
Source: Google Analytics (2017)

More interestingly, of the 12,594 sessions, 12% of the sessions originated from a mobile device, but access was mainly through laptops and desktops 88% (see Figure 1.17 below). This means that there is some level of adoption for mobile learning taking place, however it was still in an infancy stage.

Primary Dimension: **Device Category**

Plot Rows | Secondary dimension | Sort Type: Default

Device Category	Acquisition		
	Users	**New Users**	**Sessions**
	3,299 % of Total: 100.00% (3,299)	3,074 % of Total: 100.16% (3,069)	12,594 % of Total: 100.00% (12,594)
1. desktop	**2,697** (81.63%)	2,499 (81.29%)	11,056 (87.79%)
2. mobile	**426** (12.89%)	403 (13.11%)	978 (7.77%)
3. tablet	**181** (5.48%)	172 (5.60%)	560 (4.45%)

Figure 1.17 Samuellearning.org Device Category 2016-17
Source: Google Analytics (2017)

Further analysis reveals that the mobile devices being used are predominantly smartphones and tablets as seen in Figure 1.18 below. The popular smartphone and tablet brand is Apple and Samsung. The significant information here is that students today are attempting to use their mobile device to access educational content, maybe at work, while in class, at home or even while relaxing. Also, the analytics reveal that the type of device being used are not traditional mobile phones but smart devices.

With respect to age distribution, samuellearning.org is accessed mainly by the 18-44 age category. Drilling down, it can be seen that 27.5% of the students are young adults while 72.5% are adult learners over 24 years old (See Figure 1.19 below).

Primary Dimension: **Mobile Device Info** Mobile Device Branding Service Provider Mobile Input Selector

Plot Rows | Secondary dimension | Sort Type: Default

	Acquisition		
Mobile Device Info	Users	New Users	Sessions
	606 % of Total: 18.37% (3,299)	575 % of Total: 18.74% (3,069)	1,538 % of Total: 12.21% (12,594)
1. Apple iPhone	**137** (22.42%)	125 (21.74%)	295 (19.18%)
2. Apple iPad	**112** (18.33%)	107 (18.61%)	368 (23.93%)
3. Samsung SM-G925I Galaxy S6 Edge	**23** (3.76%)	22 (3.83%)	47 (3.06%)
4. (not set)	**19** (3.11%)	16 (2.78%)	57 (3.71%)
5. Microsoft Xbox One	**16** (2.62%)	14 (2.43%)	50 (3.25%)
6. Samsung SM-G930F Galaxy S7	**13** (2.13%)	12 (2.09%)	37 (2.41%)
7. Samsung SM-N910H Galaxy Note 4	**11** (1.80%)	11 (1.91%)	25 (1.63%)
8. LG D800 G2	**10** (1.64%)	10 (1.74%)	16 (1.04%)
9. Samsung SM-G900A Galaxy S5	**9** (1.47%)	9 (1.57%)	27 (1.76%)
10. Samsung SM-G935F Galaxy S7 Edge	**9** (1.47%)	9 (1.57%)	23 (1.50%)

Figure 1.18 Samuellearning.org Mobile Device 2016-17
Source: Google Analytics (2017)

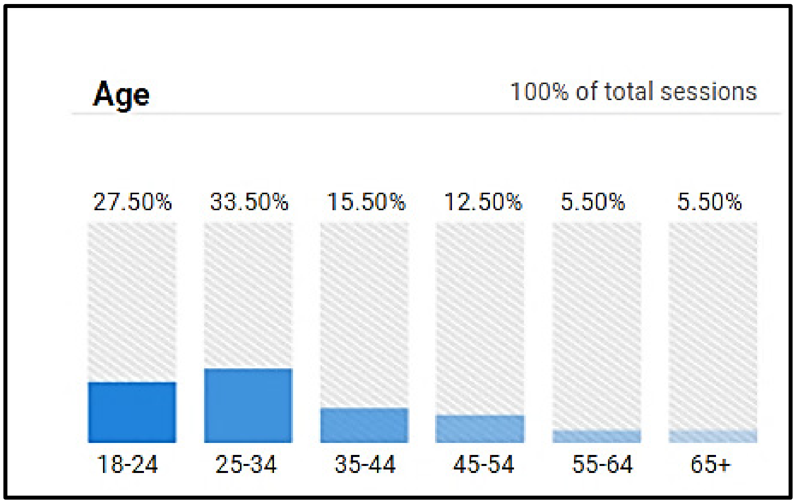

Figure 1.19 Samuellearning.org Age Distribution 2016-17
Source: Google Analytics (2017)

So, there is context for this research to focus on adult learners, given the evidence presented. However, the potential of mobile learning is not automatic nor is it a simple task, in order to seize this exciting opportunity higher education providers must "understand how new technologies and initiatives will impact education" (GSMA and McKinsey & Company 2012, pg. 4). In fact, according to UNSECO (2012a, pg. 6) "moving mobile learning from the starry realms of 'potential' and 'promise' to the solid ground of 'practice' requires planning, persistence, and a healthy dose of trial and error".

Mobile learning, while it has been researched for more than a decade globally, is still very much in its infancy stage in Trinidad as there is currently minimal research into these initiatives to determine how mobile learning can contribute to quality higher education. Therefore, this gap needs to be explored, to reveal the pedagogical strategies required to optimize learning in the contemporary educational paradigm.

Before any further details on the research purpose is given, it is important to identify the scope and scale of the research being undertaken on the basis of the research context analysed above, which covered aspects of the student demographics and the industry, which clearly provides the basis for delimiting the research. Therefore, the following section will provide insights on the specific boundaries and focus of the research.

1.8 Research Scope

The researcher intends to focus his research on the private tertiary education sector as this sector predominantly enrol part time students, who are essentially adult learners. This segment is significant for this study because adult learners today are digital immigrants and even though, according to Prensky (2001) digital immigrants adapt to emerging technology, they will still retain their digital immigrant accent, that is, they are becoming more tech savvy on the surface. So, regardless of the technology advancement in usability of mobile devices the current generation of adult learners still face challenges in adoption and they also have a different set of learning needs. This issue becomes even more important as adult learners will eventually be entering into higher education with digital wisdom as digital immigrants and will therefore become a dying species in the not too distant future (Prensky 2012).

It is therefore critical that there is an understanding of the antecedents of their needs and intention to adopt, since future usage of mobile learning environments will not focus on technology adoption issues but rather on continuance of use on the basis of motivation and pedagogy. This can be very useful for higher education institutions with regards to developing mobile learning environments.

The other major aspect of the research scope (see Figure 1.20 below), involves the higher education environment, the researcher will focus only on the teaching and learning element (pedagogy) of the education environment and not administration, support or assessment.

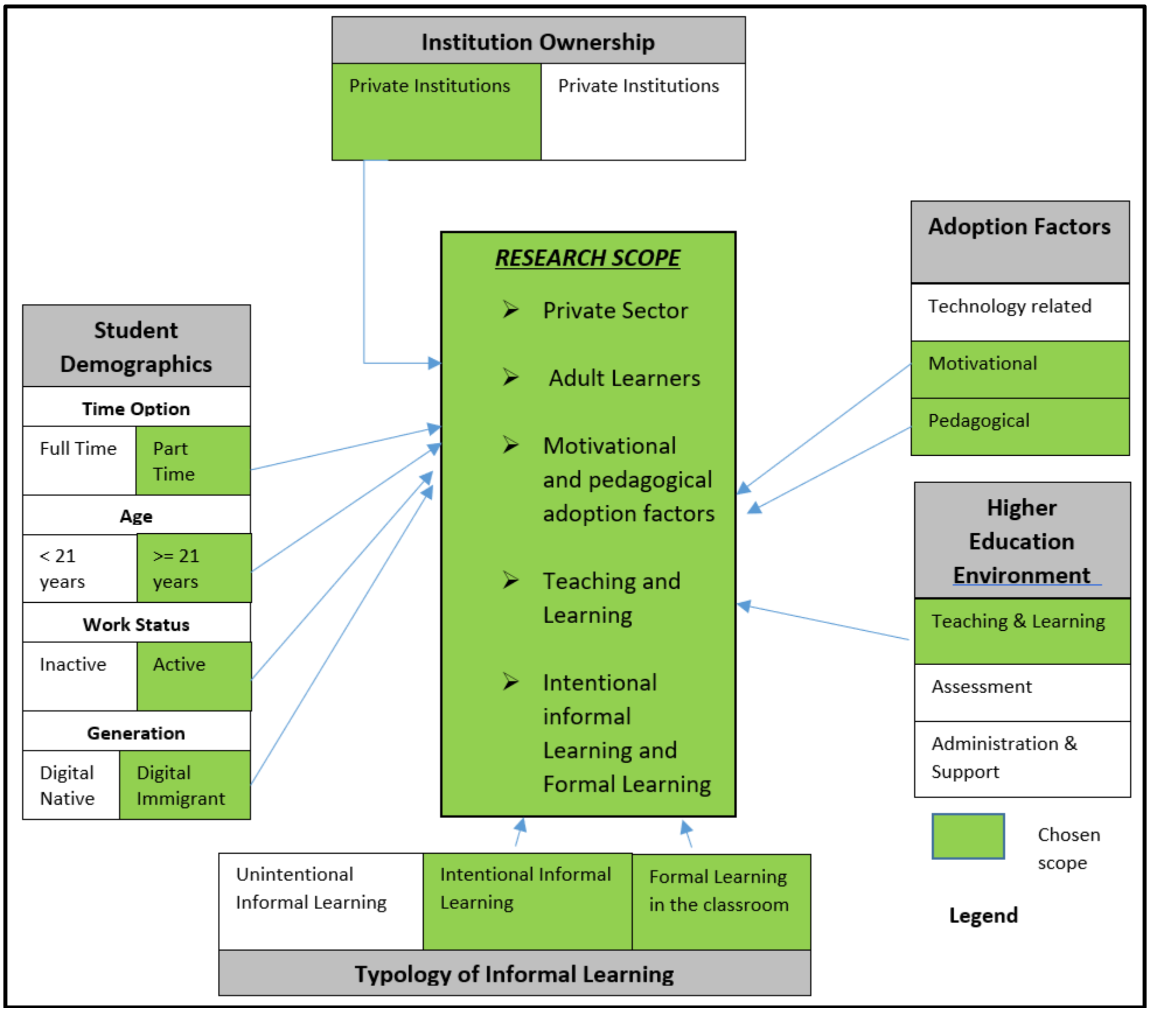

Figure 1.20 Research Scope
Researcher (2014)

There is a great opportunity to use mobile technology to evolve the learning experience of students in such way that engages them and improve their academic performance. The researcher's assertion is that mobile learning will fail if it is just added on to the existing model. What is needed is a critical change in direction from the current dominant approach, by determining what type of experience must be delivered to meet the expectations of the student and then integrate the required mobile learning environment. Anderson and Dron (2012, pg. 2) suggest that "for optimal performance the pedagogy and the technology must create an engaging and compelling dance".

1.9 Research Question

Based on the above discussion of the research scope and context the following question is articulated by the researcher:

> **How can the adoption of Mobile Learning be used to augment the pedagogical strategies currently used for adult learners in the private higher education sector in Trinidad?**

1.10 Research Aim and Objectives

Aim: The researcher's intention is to facilitate the transition of private higher education institutions from a traditional classroom environment to a blended learning environment enabled by constructivist pedagogy. Therefore, the core aim of this research is *to develop a framework for mobile learning adoption that would optimize the convergence of mobile technology and pedagogy which would enhance the learning experience of adult learners.* This framework will facilitate the design of a new learning environment which incorporates mobile learning into the existing teaching and learning process used by private higher education institutions in Trinidad.

In order to achieve this and propose a framework that adequately postulates an answer to the research question, the study focused on two key themes. Firstly, mobile learning adoption, since the implementation of a mobile learning environment poses institutional challenges (Wang et al 2009). Secondly, in shifting the teaching and learning practice from cognitive to constructivism, it necessary to consider the learners' preference towards the constructivist learning style that is afforded through mobile learning. Especially, in the context that the preference towards technology enhanced learning can have implications for adoption (Thongsri et al 2018). In essence, it is imperative to investigate these two themes in designing a mobile learning environment that reflects the learners needs. This will ensure continued motivation to use mobile learning leading to student engagement and improved academic performance.

Hence, it is within this context the following objectives were derived in order to operationalize the research purpose.

Objectives:

1. To evaluate the ***motivational factors*** that influence behavioural intention of adult learners to use mobile learning.
2. To evaluate the ***pedagogical factors*** that influence behavioural intention of adult learners to use mobile learning.
3. To explore the mobile learning preferences of adult learners based on ***constructivist learning***.

The above key elements of the research purpose, when put together forms the research framework (see Figure 1.21 below) which provides the core direction of the research.

1.11 Significance of the Research and Originality

The originality of the research stems from the lack of research into adoption of technology enhanced learning in Trinidad and the wider Caribbean. The researcher through a search of online databases and journals found only one mobile learning project in Trinidad by Kalloo and

Mohan (2007) which focused on solving the problem of low pass rates in secondary school mathematics.

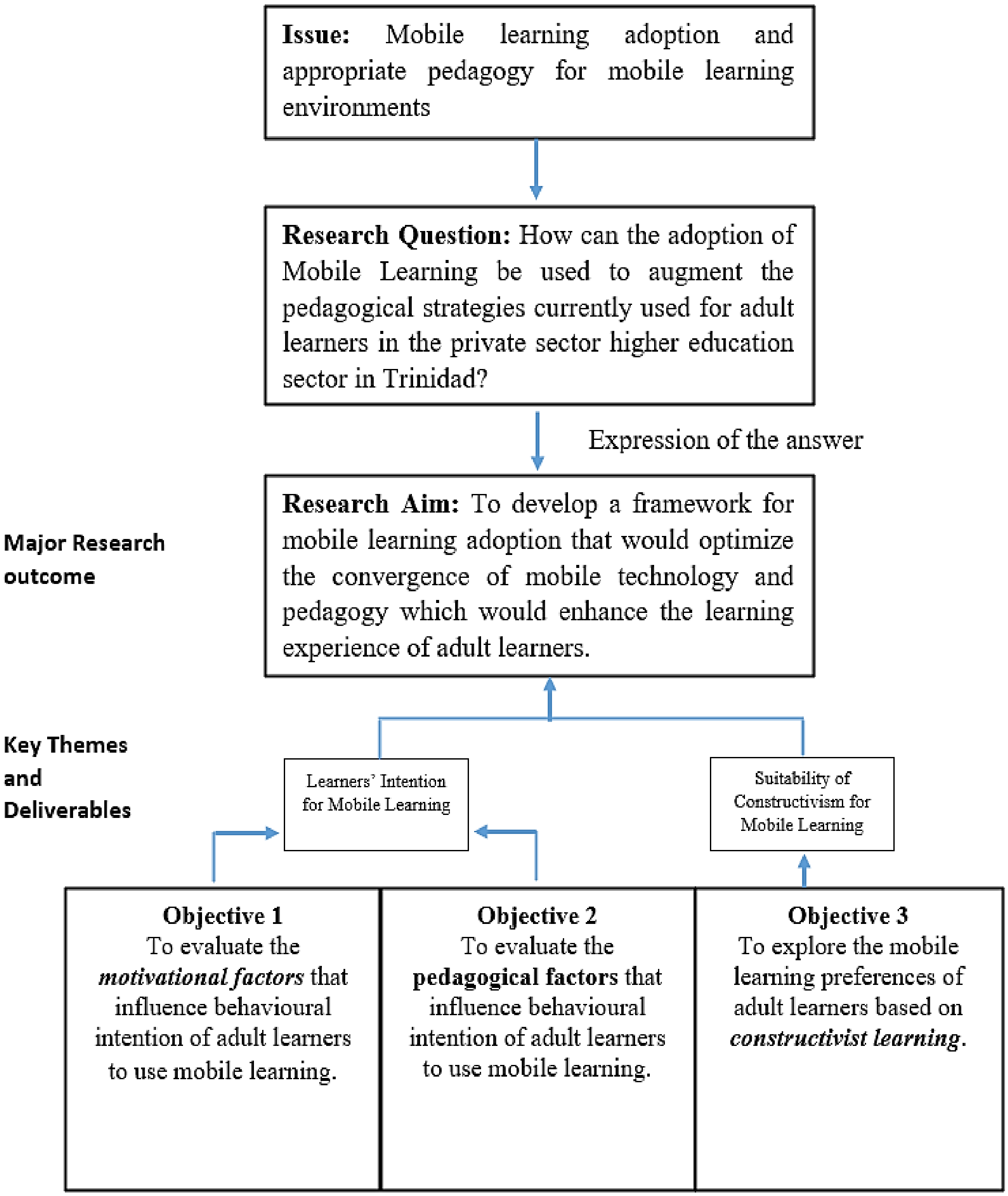

Figure 1.21 Research Framework
Researcher (2017)

Also, there was one research paper on mobile learning readiness in Caribbean tertiary institutions by Figaro-Henry et al (2011). Clearly, there is a significant research gap in Trinidad, as there is minimal research on how mobile technology can be used in higher education and what are the attitudes of adult learners towards mobile learning. Essentially, the research would be the **first** in Trinidad that will study:

1. Mobile learning adoption by adult learners, and
2. Mobile learning as a catalyst to change the pedagogical approach of private tertiary institutions from instructor-led, traditional classroom environment to a student-centred, constructivist environment.

1.11.1 Theoretical Contribution

There are several research gaps from a pedagogical perspective in the majority of mobile learning research projects, according to Cochrane (2014), but two are relevant to this research.

Firstly, there is a lack of explicit underlying pedagogical theory as suggested by Traxler & Kukulska-Hulme (2005a). Also, there is a lack of understanding of the impact that learning style (Karimi 2016) and the learner's locus of control (Hsia 2016) will have on mobile learning adoption. This point is further exacerbated as the existing theories on learning styles in a traditional learning environment from Honey and Mumford (1992) Kolb (1984) and Felder and Silverman (1988) were not developed for a ubiquitous learning environment created by mobile technology. It is further compounded as mobile learning enriches the learning process by making learners more active (Looi et al 2010) resulting in "learning environments which align with the ideas about the practice of constructivism in education" Lai, Hwang, Liang and Tsai (2016, pg.538). So, instead of focusing on the learning cycle of Kolb (1984), the behavioural tendencies of the types of learners Honey and Mumford (1992) or learning preferences of Felder and Silverman (1988), this research focused on the more conceptual issue of constructivism. Thus, the research will explore and shed light on adult learners' preferences towards a constructivist mobile learning environment.

Secondly, there is a lack of awareness of the ontological shifts (Chi & Hausmann, 2003) required for both the learners' conception of learning and the lecturers' conception of teaching. Furthermore, as the literature suggests there are challenges, none more important than the issue of promoting the adoption of mobile learning (Huang, Lin & Chuang, 2007; Liu et al, 2009; Liu, Han & Li, 2010) and the students' readiness to accept the use of mobile learning (Corbeil & Valdes-Corbeil, 2007 as cited by Hashim et al 2014).

Several studies have adopted the Technology Acceptance Model (TAM) by Davis (1989), which originates from the field of information systems, as the baseline for investigating acceptance of educational technologies (Khanh and Gim 2014). Furthermore, Park (2009) and Park, Nam and Park (2008) purported that TAM was useful in determining E Learning acceptance. In yet a further study by Park et al (2012) the TAM framework was used as the basis to examine the factors of mobile learning adoption of Korean students. It must be noted that the TAM is not without its critics, for instance Legris, Ingham and Collerete (2003) suggested that the TAM excludes the usage environment and external factors including the socio-cultural context. In addition, the majority of studies that used TAM to explain mobile learning adoption, were conducted in developed countries (Thongsri et al 2018). This is important to note, as Traxler & Kukulska-Hulme (2005a) suggests that a prescriptive approach must be guarded against given that the research is located in the developing country of Trinidad with a specific mobile environment and socio-cultural factors for learning.

The significance of the research is therefore derived by extending the Technology Adoption Model (TAM) to include the learners' motivational determinants by integrating Uses Gratification Theory (UGT). This integrating of theories can be seen in the theoretical framework for the study in Figure 1.22 below. Additionally, the research will address the pedagogical gaps in the literature with respect to understanding the learners' mobile learning preference towards a constructivist learning environment.

Furthermore, most of the previous research on mobile learning adoption focused primarily on technology related factors for adoption (Liu et al 2010) and as suggested by Karimi (2016, pg. 770) there are "merely a handful of studies examining learners' motivational factors". Therefore, there is a lack of understanding of the motivational factors for using mobile device to learn (Ciampa 2013), as such this study sought to shed light on the motivational factors as well.

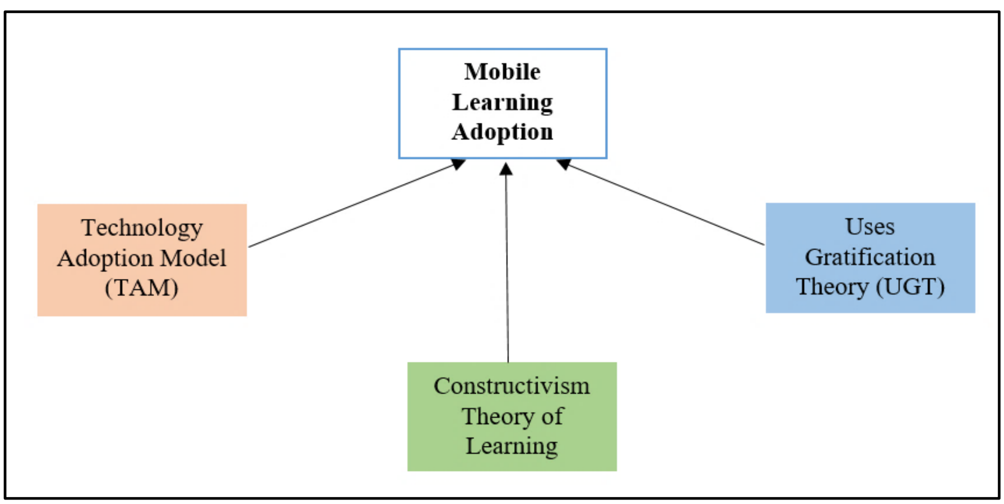

Figure 1.22 Theoretical Framework of the Study
Source: Researcher (2020)

1.11.2 Summary of Implications for Practice and Theory

So essentially, the study will contribute to the existing mobile learning adoption theory by developing a framework that can be used to predict adult learners' behavioural intention towards mobile learning environment in a developing country. Holistically, the research will contribute as follows:

1. **Theory:** Add to the body of knowledge concerning mobile learning adoption
2. **Practice:** Help private higher education institutions in Trinidad formulate teaching strategies that will motivate adult learners to use mobile learning
3. **Theory:** Add to the body of knowledge regarding technology as an enabler of constructivist pedagogy
4. **Practice:** Help private higher education institutions in Trinidad formulate a seamless teaching and learning model which incorporates mobile technology, that closes the gap between formal and informal learning space, thereby enhancing student engagement with the curriculum.

Ultimately, the goal is to bridge the gaps in the current teaching and learning strategy of private higher education institutions which have premised their business model on situated distance learning, using the University franchise model. Therefore, the findings from this research can in the long run provide the impetus for institutional change towards technology enhanced learning.

1.12 Research Design and Methodological Insight

In order to achieve the purpose of the research and advance reliable, valid and generalizable contributions to knowledge and implications to practice which are relevant to the socio-cultural context. The researcher utilized an interpretivist paradigm which ensured that there was symbiotic harmonized interaction with the learners who participated in the research so as to ensure that their voices were heard. This underlying philosophical assumption and world view was important to the research, since in developing any new mobile learning environment it is critical to satisfy the variations in the needs and preferences of learners for this environment. This therefore, required a dialectic relationship between the students and the researcher. This requirement was further fulfilled by applying action research as the overarching design and strategy. The action research involved the launch of the SAM Learning 2 Go (SL2G) project, essentially a scaled version of a mobile learning environment to support two (2) MBA modules delivered to three (3) clusters of students enrolled during the academic year 2016-17. This allowed the researcher to evaluate feedback from the students, in light of their experience, on their intention to adopt mobile learning.

In order to gather the feedback at the end of the action phase of the project, an online questionnaire was used to evaluate the motivational and pedagogical factors that influence mobile learning adoption. Furthermore, the online questionnaire sought to explore the mobile learning preferences towards a constructivist learning environment. The method of an online questionnaire was preferred so as to improve generalization of the study findings and to create alignment with the prevailing context of the research problem. Additionally, the online questionnaire was used to reduce the potential of insider research bias, which is inherent in action research. The researcher utilized descriptive and inferential statistics to analyze each of the constructs used in the research. In addition, confirmatory factor analysis and structural equation modelling was used to evaluate the total effect of each construct on the behavioural intention of students to adopt mobile learning.

1.13 Organization of the Thesis

This thesis is organized into four main processes, that is, setting the stage, the theoretical framework, the research process and the results. These sections and the content herein are important as they allow for the accomplishment of the research purpose through a structured research process.

Firstly, Setting the Stage, which entails Chapter 1 Introduction. This chapter provided the context of the research, the research scope and boundaries and more importantly the rationale for conducting the study. In addition, the chapter articulated the research problem and as a result the overarching research question was articulated along with research objectives.

Secondly, The Theoretical Framework, consists of 2 Chapters. The first being Chapter 2 Pedagogy and Learning Theories; this chapter provided the underpinning theoretical base for objective 2 and 3 of the research. Therefore, this chapter reviewed literature on conventional theories of learning as well as mobile learning theories. Furthermore, the researcher provided a critical debate and interpretation of the literature on learning style and preference suitable for learning in a mobile environment. The second chapter, Chapter 3 Mobile Learning Adoption Theory, focused on the concepts that were necessary to support the achievement of objective 1 and 2 of the study. In other words, the chapter provided a review of Technology Adoption Model (TAM) and Uses Gratification Theory (UGT) as the research sought to extend the TAM by integrating construct of UGT to explain students' intention to adopt. The chapter culminated with the presentation of the conceptual framework that was used to guide the next stage of the research, that is, the research process.

Thirdly, The Research Process, consist of Chapter 4 Research Design and Methodology. This chapter was written keeping in mind the main purpose of the chapter, that is to provide a defense of the reliability, validity and generalizability of the key findings, conclusions and contribution to knowledge as well as to elucidate how the research objectives were achieved. Thus, the chapter covered the underlying philosophical assumptions and subsequent choice and justification of the chosen research paradigm. In addition, the chapter provided a discourse on the action research project, the data collection procedure and the instrument design. Lastly, the chapter discussed the data analysis techniques used in transforming the raw results into empirical findings.

Finally, The Results, which consists of two chapters; the Chapter 6 Analysis and Discussion and Chapter 7 Conclusions. The later chapter presented the results from the outcome of data analysis using the research objectives as the goalpost. Thereafter, the researcher entered into a discussion of the results so as to make reasoned judgements and interpretations of the same. Ultimately, this led to Chapter 7 Conclusions, where the summary of the major findings for each research objective articulated in chapter 1 was presented. Furthermore, propositions towards the answers to the research question was advanced as well as recommendations for future research based on the limitations of the study. Lastly, but most importantly this final chapter discussed the study's contribution to knowledge and the implications to practice.

1.14 Chapter Summary

This chapter provided the much needed insights on the research purpose and scope, where the boundaries and scale of the research was defined. More importantly, the chapter articulated the central research question based on the research issue as well as the research objectives demonstrating the smaller outcomes of the research culminating in the formulation of the research framework (see Figure 1.21 above). This framework will provide the researcher with the direction needed for executing the research process. In addition, the research framework will also form the basis for determining the necessary theoretical underpinnings which will be discussed in the next chapter.

CHAPTER 2 PEDAGOGY AND LEARNING THEORIES

2.0 Introduction

Laurillard (2013) suggests that the underlying foundation of learning and what it takes to learn and the understanding of how students learn has not been challenged to date. As such, in the quest to find answers to the research question and to address research objective 2 and 3, the researcher will first seek to define the term pedagogy from a higher education perspective. In addition, it will be remiss of the researcher not to critically review the relevant learning paradigms and theories and its implications for mobile learning practice. The review will also seek to provide an analysis of the relevant mobile learning theories and frameworks as well as learning styles and preferences relevant to a mobile learning environment. More pointedly, this chapter will provide the underpinning literature support needed to evaluate the pedagogical factors that influence behavioral intention of adult learners to use mobile learning and to explore the mobile learning preferences of adult learners based on the constructivist learning.

2.1 Defining Pedagogy in higher education

The most common definition of pedagogy is the 'art of teaching', the term art means that teachers make "intentional decisions based on a set of beliefs" (Breault 2011, pg. 634) to impart knowledge onto students. Freire (2010, pg. 72) coined the term 'banking', that is, "the act of depositing, in which the students are the depositories and the teacher is the depositor".

Hamilton (2009, pg.6) notes its Greek roots, being derived from the word 'paidagogos'. So, to put it simply, in ancient Greek terms pedagogy denotes the logic of leading children. This view puts the emphasis on the act of teaching and learners were viewed as passive responders or as stated by Freire (2010) objects. In this approach the teacher is seen as an authoritative figure and the dialogue with students is instructional, essentially, didactic. It follows the practice and attitude of “the teacher knows everything and the students know nothing” Freire (2010, pg. 73). This is further supported by Künzli (1994 as cited in Gundem 2000, pg. 236) who suggests that didactics is concerned with the processes of the person learning (the know-how) and the particular content to be learned (the knowledge).

The main point to take from the discussion thus far is that the knowledge imparted to students is controlled by the authority of the teacher and is external to the student. Freire (2010) purported that the banking approach would create a student who would never critically consider reality and that their adaptation to the world would be based on the patchy view of reality deposited in them. This creates a dichotomy between the students and the world which limits their ontological inclination to be open minded about the world, a truly teacher-centred pedagogical approach.

However, the emergence of new theories of learning have challenged the usual definition of pedagogy as the art of teaching and the notion of innate ability of the learner independent of the environmental, social and cultural influences on their capacity to learn. Many have argued that the emphasis had been placed on content which had led to unhelpful habits of instruction, as such the term Learning is preferred over Teaching.

In current theories of learning, the responsibility for learning rests with both students and teachers. Students are expected to engage in the learning process, not be receptacles or passive but to think critically of the knowledge in the context of reality and to authenticate the learning outcome by questioning views of the teacher.

These are the sentiments echoed by Freire (2010, pg. 77) who states that the teacher's thinking can only be authenticated by the student's authentic thinking, "thinking that is concerned about reality". So, for Freire learning required a dialectical relationship between teachers and students without dichotomizing the reflection of reality thus establishing an authentic dialogue between them. Lerman (1993) agreed with this concept of pedagogy and suggested that teachers must find ways to help students create and negotiate their meaning of reality.

Bruner (1985, pg. 24) proposed that the teacher "serves the learner as a vicarious form of consciousness until such time as the learner is able to master his own actions". Furthermore, for Bruner (1986) culture is a key contextual factor in the learning process for students. Bruner (1986) further stated that culture is the "implicit semi-connected knowledge of the world, from which, through negotiation, people arrive at satisfactory ways of acting in a given context." From this standpoint of learning, the teacher has the job of making cultural practices available to students for deliberation so that they can interpret reality from their own view.

Freire (2010) calls for authentic liberation by rejecting the banking concept of education and replace it with problem-posing education and to view "education as the practice of freedom". He suggests that through these approaches students would develop critical thinking since they would feel obliged and challenged to respond to the problems posed to them.

In summary, this move away from the beginnings of pedagogy as the science of teaching, teacher-centred to a now truly student-centred environment, where the focus is not on teaching but rather on learning, reflects a new epistemological stance in education. There is a need to create a dialectic relationship between the theory of learning and the practice of teaching, so as to create a dialogue between theory and practice. Similar to what Freire (2010) suggested when he called for an authentic dialogue between the teacher (practice of teaching) and the learner (the theory of learning). Schon (1987) advocates for the reconnecting of these aspects of pedagogy, teaching and learning through reflective practice, where practitioners actively evaluate the impact of their pedagogical approaches on their learners.

In light of the digital age, more so the mobile technology age, teachers are often excited to use technologies without consideration of the theories of learning and the practice of teaching, which often results in an unsuccessful pedagogical approach. But when they are successful, practitioners must not be caught up in just reproducing practice but to recognize the potential of digital technology to make learning innovative and also recognize the implications derived from the theory of learning.

These issues that have led the researcher to a critical review of the theories of learning presented in the succeeding section in lieu of trying to progress towards the answer to the research question.

2.2 Conventional Theories of Learning

The generations of learning theory remain as effective as the technology used in the past to enhance learning. Whilst the existing theories of learning still remain relevant in today's digital age (Laurillard 2013), the emergence of new technologies such as mobile smartphones and in particular mobile apps has sparked considerable debate on the implications for teaching and learning practice based on the theories of learning. This section will firstly look at the underlying philosophy and theoretical underpinning of each learning theory and secondly, its implications for mobile learning practice.

2.2.1 Behaviourism

Behaviourism took its roots as a predominant theory of learning during the early 20th century. This approach is based on the work of Pavlov (1897) classical conditioning which is the process of reflex learning. Pavlov work focused on producing a conditioned response by using eventually only some conditioned stimuli, in other words it led to learning by association that would trigger a particular behaviour. Pavlov postulated the Law of Temporal Contiguity, where he found that for learning by associations to be effective, the time frame between the two stimuli, that is, the conditioned stimuli and the unconditioned stimuli, had to be presented in close proximity to each other.

Another form of producing behaviour was based on operant conditioning, where learning took place as a result of consequences. The leading author Thorndike (1905) postulated the Law of Effect which simply suggest that people would repeat behaviour if the resultant effect is pleasing but avoid a behaviour which produced a less pleasing effect.

Skinner (1948) built on the work of Thorndike by adding the concept of shaping behaviour through reinforcement. So, through positive reinforcement, conditioned behaviour would be stimulated. For example, if students are rewarded for a certain preferred behaviour, they are likely to repeat it at some later point in time.

The implications of Pavlov, Thorndike and later Skinner work on learning, can be summarized based on the notion that learning occurs when learners adopt a preferred behaviour as a consequence of a response to some stimuli. So, preferred response of learners can be triggered through stimuli that learners like or dislike or through stimuli that shapes behaviour by using positive or negative reinforcement.

Applying behaviourism to technology enhanced learning, like that of mobile learning, would involve the presentation of a stimulus, for example a mobile app quiz game, and the subsequent response of the learner to the quiz. But the critical component to completing the learning process is appropriate feedback, which would make the learner aware of which response is preferred. According to Dennen and Hao (2014) feedback may be provided in the form of functional interaction indicators, for instance confirmation that a choice was made or through performance indicators such as assertion that a correct choice was made.

Feedback can also be used to shape behaviour, but this requires instant feedback, otherwise Pavlov's Law of Contiguity would apply. This means there should be a limited delay in providing feedback to learners so as to make the activity meaningful. Furthermore, regular synchronous feedback can encourage a learner to progressively develop and shape a preferred behaviour over time (Dennen and Hao 2014) which is linked Skinner's work discussed above.

Feedback systems can also have implications for Thorndike's theory of the Law of Effect. It can be used to provide rewards to students, for example points or ratings feedback, the more points scored, the more likely the learner to repeat that behaviour that generated that positive response.

2.2.2 Cognitive Approach

Cognitive models of learning arose from the need to explain learning behaviour from a motivation, attitudes and mental barriers perspective (Anderson and Dron 2012), since behaviourism only partially shed light through observed external behaviour. Cognitive Learning puts the focus on the internal processes of the individual and how they comprehend, store and retrieve information in their memory, therefore, it is based on the Information Processing Model of Miller (1956). He provided the important concept of 'chunking' and the capacity of short term memory. Miller (1956) purported that "short-term memory could only hold 5-9 chunks of information". Atkinson and Shiffrin (1968) agreed with this concept and postulated the widely accepted model shown in Figure 2.1 below.

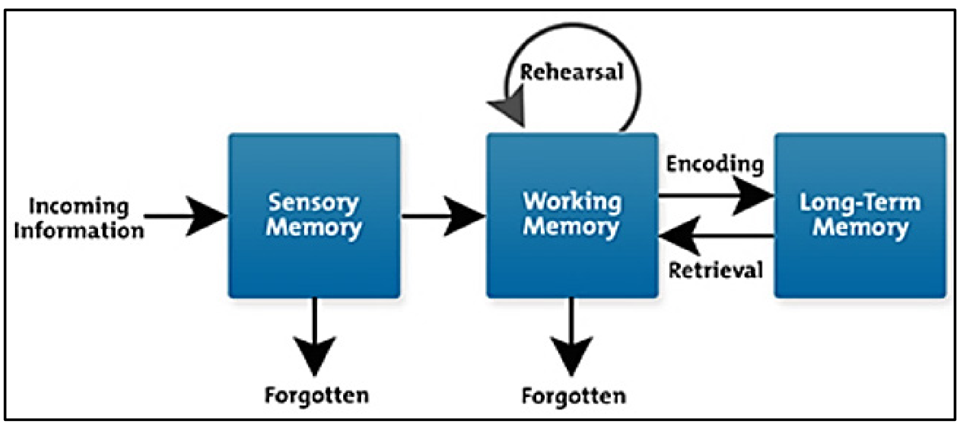

Figure 2.1 Information Processing Model.
Adapted From Atkinson and Shiffrin (1968)

The model suggest that incoming information is first processed by an individual's sensory memory, which keeps important content and passes it to working or short term memory where it is either forgotten or processed. During the processing, the individual's brain categorises the information and store it as schemas in long term memory.

This concept affects the cognitive ability of the learner to pass information from short term memory to long term memory, but more importantly how much information can be stored effectively. This issue relates to the Cognitive Load Theory proposed by Sweller (1988) which builds on the Information Processing Model.

Sweller (1988) advocated that instructional design should avoid overloading short term memory, since it has limited storage capacity and doing so would not directly contribute to learning. Cognitive Load Theory suggest that short term memory can be extended by using instructional design that firstly accommodates for the issue of chunking and secondly the issue of Modality Effect, that is, the individual's brain processes visual and auditory information separately.

So, the implication of Cognitive theory on learning can be summarized by asking how instructional designers must manage the information load? And what are the appropriate communication channels, and encoding strategies?

Given that Cognitive Learning is concerned with how learners organize incoming information into long term memory and the manner in which they associate each schema, educational technology should provide the affordance to assist learners in this respect. Moreover, the implication for mobile learning "include multiple communication channels, information chunking and encoding strategies" (Dennen and Hao 2014, pg. 25).

Mayer and Moreno (2003) researched how communication channels in a multimedia context can be combined to enhance learning. Their research found that student learning was enhanced when a combination of animation and narration was used as opposed to a combination of written text and a narrated animation. Also, the combination of words and pictures was more effective than content with words alone. Therefore, by using the right combination of channels the learner can attain the Modality Effect and thus be able to pass more of the incoming information into firstly short term memory and then categorized and store the meaning into long term memory.

Critical to reducing cognitive load is the concept of ‘chunking’, with this in mind, the challenge is to “determine the best ways to group information as that it can be efficiently and effectively conveyed to learners” (Dennen and Hao 2014, pg. 26). Mobile app designers must consider the structure of the instructional material by grouping content under headings and relating these to each. Also, mobile learning designers must decide on how to use screen space, what content goes where and how to cascade the content.

2.2.3 Constructivism- Cognitive and Social

The first two generations of learning theories have been focused primarily on the individual learner and notion that knowledge is deposited to them in a didactic approach. In contrast, constructivism is concerned with personal construction of knowledge based on their interaction with their peers and the environment (Anderson and Dron 2012). In this context learners are seen as active learners rather than passive learners. These sentiments are echoed by Piaget (1970), who rejects the behaviourist and cognitivist views which fail to take into account the nature of evolution (Peterson 2012). In Piagetian theory, knowledge should not be construed as a pre-existing reality or a reality separate from the learner, but should be seen as a result of the learner’s own constructions based on experiences. Piaget (1972, pg. 95) believes that the constructivist method seek access to an “internal epistemology”. Further to this Piaget (1970, pg.2) articulates that the individual's development of knowledge is a process of continual construction and reorganization.

Piaget's (1970, 1972) research focused on the individual level rather than a group of learners, as such, this form of constructivism is often called Cognitive Constructivism. The implication of Piaget theory of learning on pedagogical practice is simple, "in order to teach one must first establish what students know, how they know it and how they feel about that aspect of their experience" (Murphy 1996, pg. 31). Essentially, it suggests that teachers must develop a pedagogical approach that encourages discovery, problem-solving and critical thinking through interactions between teacher and learner, where the later would be guided towards achieving their explicit goals.

Vygotsky (1978, pg. 79-80) whose theory is categorized as Social Constructivism, critiqued Piagetian theory for its assumption that processes of development are independent of learning and that learning is a "purely external process that is not actively involved in development". Vygotsky suggested that because of this assumption, which was inherent in the questions Piaget used in his experimental investigations, "it precludes the notion that learning may play a role in the course of development" (Vygotsky 1978, pg. 80). He also critiqued the behaviourist's stimuli-response theories, suggesting that these theories reduce learning to habit formation and assumed that "if someone learns to do any single thing well, he will also be able to do other entirely unrelated things well as a result of some secret connection" (Vygotsky 1978, pg. 82).

Vygotsky (1978) had a different perception of human ability, he postulated that the mind has a set of specific capabilities, which are developed independently of each other, as such, he advanced the theory on the Zone of Proximal Development (ZPD). This zone is defined by "the distance between the actual development level and the level of potential development" (Vygotsky 1978, pg. 86) see Figure 2.2 below. He further expounds that the ZPD delineates the developmental levels which are in an embryonic state, that is, abilities in the progression of maturation.

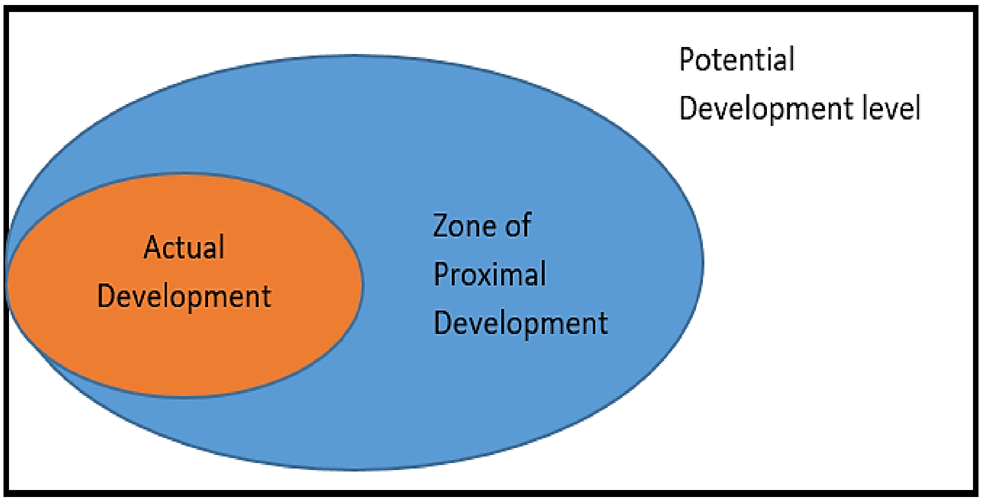

Figure 2.2 Zone of Proximal Development.
Source: Author (2014)

The chief implication of Vygotsky's work is that it steered the practice of teaching and learning towards a student-centred approach. In order to move a learner from the ZPD to actual development, they required adult guidance and collaboration with more capable peers. So that, what a student can do under guidance today will eventually be developmentally achieved and independence of thought would be gained. In addition, learning is enhanced when the learners interact with people and the environment in which they are situated.

Cobb (1994) has characterized the two positions on constructivism (see Table 2.1 below), he contends that the two perspectives are complimentary. Cobb (1994, pg.19) further advocated for a pragmatic view of the two perspectives, one where the teachers' awareness of the social reality, dictates and justifies the perspective adopted.

	Cognitive Constructivist	Sociocultural Constructivist
The mind is located:	in the head	in the individual-in-social interaction
Learning is a process of:	active cognitive reorganization	acculturation into an established community of practice
Goal is to account for:	the social and cultural basis of personal experience	constitution of social and cultural processes by actively interpreting individuals
Theoretical attention is on:	individual psychological processes	social and cultural processes
Analysis of learning sees learning as:	cognitive self-organization, implicitly assuming that the child is participating in cultural practices	acculturation, implicitly assuming an actively constructing child
Focus of analyses:	building models of individual students' conceptual reorganization and by analyses of their joint constitution of the local social situation of development	individual's participation in culturally organized practices and face-to-face interactions
In looking at a classroom, we see:	an evolving microculture that is jointly constituted by the teacher and students	instantiation of the culturally organized practices of schooling
In looking at a group, we stress:	the heterogeneity and eschew analyses that single out pre-given social and cultural practices	the homogeneity of members of established communities and to eschew analyses of qualitative differences

Table 2.1 Characteristics of Cognitive and Social Constructivism (adapted from Cobb 1994)
Source: Duffy and Cunningham (1996, pg.6)

The implications of constructivism on mobile learning practice include scaffolding and communication (Dennen and Hao 2014). Vygotsky (1978) used the term scaffolding to describe a pedagogical approach where the teacher actively supports students based on their individual needs, to make the learning easier. Moreover, Daniels (2001, pg. 59) stated that "the term could be taken to infer a one-way process wherein the scaffolder constructs the scaffold alone and presents it for use to the novice". Therefore, the concept is based on providing support at the beginning of the learning process or when students are in ZPD as defined by Vygotsky (1978), and then removing the support when the learner has progressed to independence. The individualization of the scaffolding relates to Piaget (1972) concept of internal epistemology of the learners and the view that the learner constructs a personal view of knowledge based on their reality. Mobile app designers can use scaffolding when designing interactions and designing the stages/levels of the learning material to match the stages of development. For example, demos might be used to show the learner how to accomplish a task, or how to solve a problem at the beginning stages but as the learner advances through the material, support may diminish as the learner gains independence.

Constructivism also emphasises the notion of collaboration, therefore, mobile learning apps must facilitate communication among a group of learners in a meaningful manner. This can be achieved by using social media apps, discussion forums, blogs and video conferencing. So, any mobile learning environment must incorporate a facility to support student collaboration which can allow learners to share experiences with each other. This will ensure that the Piagetian theory of learning from experience and Vygotsky theory of learning from peers, for learners who are in the ZPD, can be fulfilled.

2.2.4 Summary of Conventional Learning Theories

The above discourse suggests that the generations of learning theory are still relevant today as their concepts and pedagogical design issues can be delivered using technology, more specifically through using mobile apps. To this end, Dennen and Hao (2014) presented four categories of app; tutor, information source, simulator and collaboration enabler. Moreover, each of these paradigms of apps can be linked to a primary learning theory. Additionally, each tend to have a secondary relationship to others as well, shown as broken lines in Figure 2.3 below. For instance, tutor paradigm mobile apps are designed based on the behaviourist principles of mastery of tasks by levels, reinforcement through rewards and instant feedback (Ertmer and Newby 2013). Additionally, learning based on information source paradigm apps are premised on the cognitive approach to learning, therefore, the key principles of learner control and self-planning, structuring and the logical sequencing of information as well as forming associations provide the basis for instructional design of these apps (Harasim 2017; Ertmer and Newby 2013).

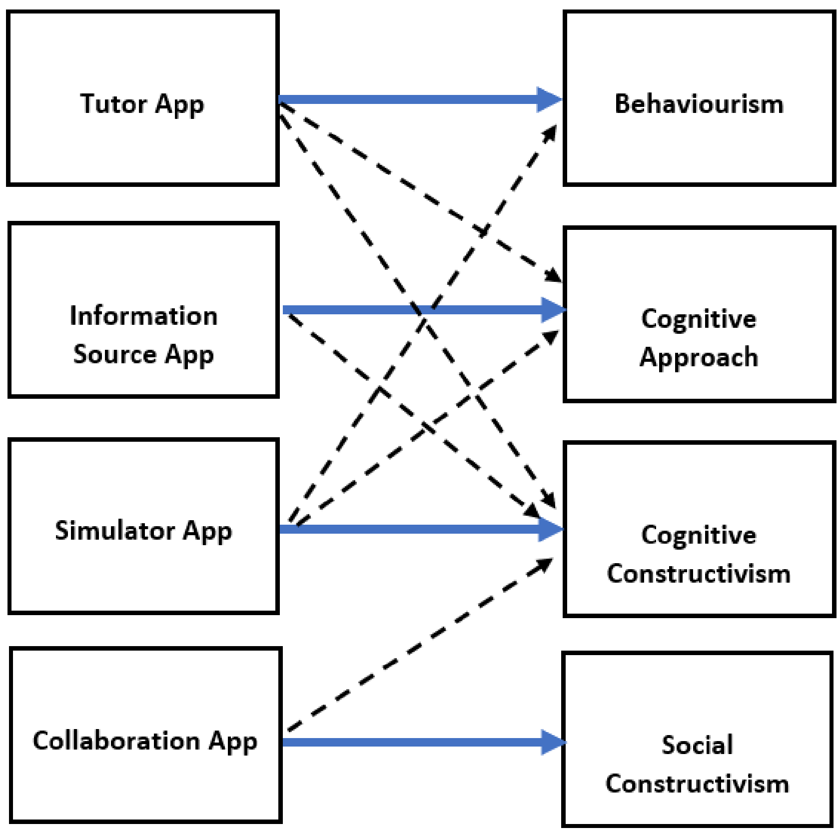

Figure 2.3 Relationship between paradigms of app and Learning Theories
Source: Dennen and Hao (2014, pg. 28)

In terms of the Constructivism, the simulator paradigm apps are aligned to cognitive constructivism while collaboration enabler paradigm apps are premised on social constructivism theory of learning. These apps are designed based on the values of constructivism, including scaffolding, active learning, collaboration and social negotiation (Duffy and Cunningham 1996, Harasim 2017; Ertmer and Newby 2013).

An alternative view is that, while the traditional learning theories of Behaviourism and Cognitive approach can be applied to the concept of instructional design for mobile learning, they were not developed specifically for technology enhanced learning. This view is held by Deubel (2003) who concludes that "no one pedagogical approach meets the design needs for all multimedia based learning" and in particular existing pedagogical frameworks may not provide adequate basis for learning using mobile technology as argued by Ozdamli (2012). Therefore, in search for a theoretical basis and pedagogical framework for mobile learning, it is necessary to explore further theories of learning that have been used to underpin mobile learning.

2.3 Mobile Learning Theory

Indeed, there is a significant gap in the existing underlying theory of learning as it applies to the use of mobile technology. This is confirmed by Traxler and Kukulska-Hulme (2005b) who stated that there is a lack of underlying pedagogical framework for mobile learning. This view is also held be Taylor et al (2006) who argued that no single current theory of learning satisfies the mobile learning environment. Furthermore, Traxler (2010, pg. 63) contends that existing frameworks for formal education are not compatible with mobile learning. Moreover, Bernacki, Crompton and Greene (2020) argued that research into mobile learning theory is nascent, as the current research agenda is largely focused on the user's experience rather than the learning process. This suggests that the existing models of learning must be challenged, changed and scaffold into practice by understanding more appropriate technology enhanced learning theories.

The intention of this section of the literature review is to unearth the key pedagogical concepts which should be considered when seeking to bridge the gap between theory and the practice of operationalizing mobile learning. In particular, Activity Theory and the theory of learning as a conversation would be reviewed, since Sharples et al (2005, pg. 4) purported that "a theory of mobile learning must be tested against the criteria, does it theorize learning as a constructive and social process". Crompton (2013, pg. 195) concurs with this view stating that "activity theory and conversational theory are popular choices for links to m-learning". For instance, researchers have examined the connectivity of actors engaged in mobile learning through the lens of activity theory (Bernacki, Crompton and Greene 2020). Furthermore, according to Sung, Chang and Liu (2016, pg. 255) several researchers have used activity theory as a theoretical basis for designing mobile learning scenarios. Moreover, in their review of experimental mobile learning research for the period 2010 to 2016, Chung, Hwang and Lai (2019, pg. 4) were able to identify and evaluate 63 papers that subscribed to the activity theory framework.

In terms of conversation theory link to mobile learning, Sharples et al (2016, pg. 68) suggests that "conversation is the driving process in learning". In addition, Kattayat, Josey and J.V (2017) accepts this view as well arguing that the learning pedagogies based on constructivism and conversation theory can be adapted to mobile learning. In light of this argument for the use of both activity theory and conversational theory as a good starting point for understanding the affordances that mobile technology can have for the practice of teaching and learning, the researcher will now turn to a review of activity theory.

2.3.1 Activity Theory

Early examples of research into Activity theory (AT) include Vygotsky (1978) who elucidated "that human beings deeply understand the things around them and acquire knowledge through meaningful actions" (Chung et al 2019, pg. 2). Furthermore, Taylor et al (2006) suggested that Vygotsky "attempted to describe learning and development as a process mediated by tools". Later, Leont'ev (1978) distinguished the concepts of activity and action, which were underdeveloped by Vygotsky (Daniels 2001, pg. 86).

These concepts and ideas provided the basis for Engestrom's (1987), initial model of Activity Theory referred to as the Vygotsky's triangle by Daniels (2001), which comprised of three elements, that is, the object, the subject and the mediating tools as seen in Figure 2.4 below.

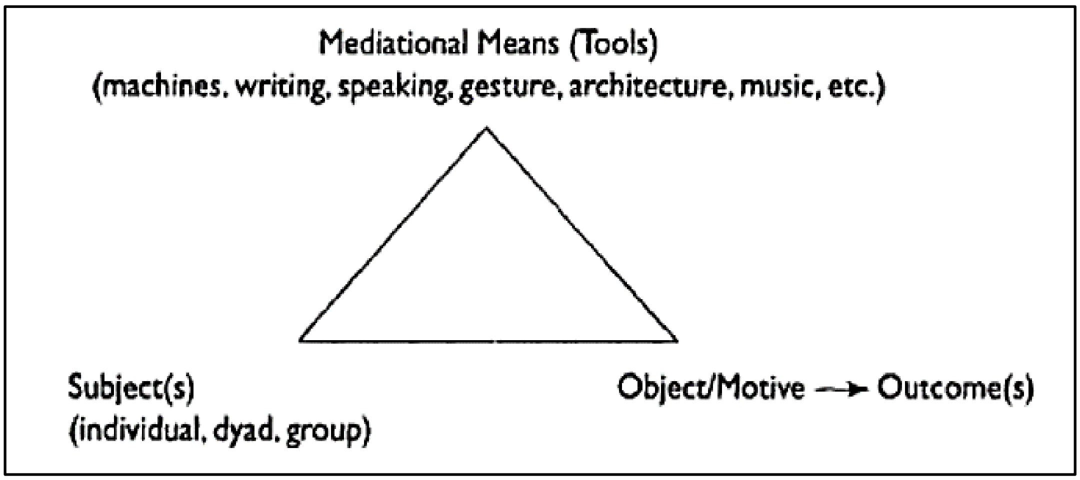

Figure 2.4 First Generation Activity Theory
Source: Daniels (2001, pg. 86)

The basic concept of mediation has implications for mobile learning, that is, the subjects, which refers to "the participants involved in activities such as teachers and students" (Chung et al 2019, pg. 2) are influenced by the motives and goals of the activity (Daniels 2001), in this case the learning outcomes of a course, the object. This results in collaborative dialogue between the subject and the object through the use a mediating tool such as mobile devices (Cowan and Butler 2013). These interactions through the mediating tools enables learning to take place as the student is able to transform their internal state of mind from the activities.

Further to this, based on the significance of the socio-cultural context underpinning of Vygotsky (1978) social constructivism, Engestrom (1999) sought to expand the AT model by adding the concept of rules, community and division of labour as seen at the base of the new AT model (see Figure 2.5 below). Since, according to Engestrom (1999, p.29) as cited by Daniels (2001, pg. 88) "the focus of the study of mediation should be on its relationship with other components of an activity system". This establishes the importance of the interrelations between the individual and the community of learning (Daniels 2001, pg. 88), in which "the social context is key to the transformation of the individual or subject" (Cowan and Butler 2013, pg.2).

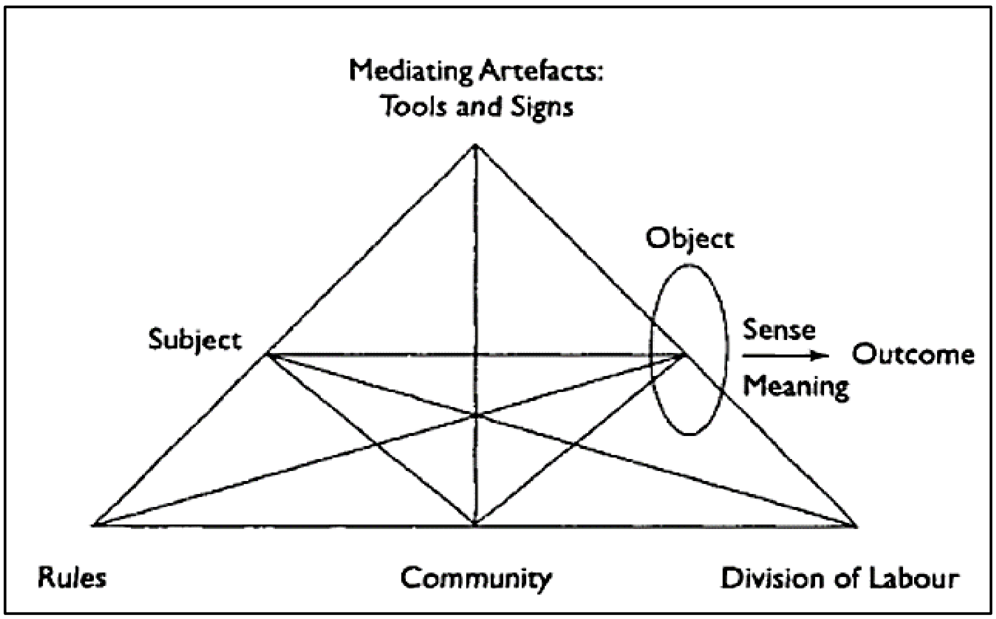

Figure 2.5 Second Generation Activity Theory (Engestorm 1987)
Source: Daniels (2001, pg. 89)

In essence, the learner should not be "a single homogeneous substance" (Chung et al 2019, pg. 2), but rather interacting with the 'community', that is, the class and wider school environment. These interactions should be based on the 'rules' as defined by the teaching and learning strategy (Cowan and Butler 2013) adopted by the teacher, which based on constructivism thinking should be a collaborative learning environment that can improve student learning. Furthermore, the community should use the ‘division of labour’ to determine and shape interactions between the subjects and the objects (Hanna and Richards 2012 as cited by Chung et al 2019, pg. 2).

In summary, as stated by Park (2011, pg. 90) “activity theory is an analytical framework for understanding an individual’s (subject) actions on learning material (objects) mediated through artifacts, interacting with a community, moderated by a set of rules and distributed by a division of labour.”

In practice, Activity Theory has been used as the basis for a number of studies conducted on mobile learning. For instance, Frohberg et al (2009) critical analysis of 102 mobile learning projects published prior to 2007. More recently, Chung et al (2019) investigation of trends and insights from experimental mobile learning projects published in 2010 to 2016. In addition, Cowan and Butler (2013) focused on the role of the teacher and the pedagogies used in mobile learning. Similarly, Da Silva et al (2014) research on the construction of pedagogical activities using mobile devices. Furthermore, Liaw et al (2010) used Activity Theory as the underpinning assumption whilst investigating the acceptance towards mobile learning, likewise Al-Emran et al (2016) and Joo et al (2016) investigated attitudes towards and factors predicting the use of mobile learning in higher education respectively.

Furthermore, the implication of Activity Theory and Social Constructivism theory to mobile learning has been demonstrated in the development of several mobile learning models. For instance, Sharples et al (2005), Taylor et al (2006) and Sharples et al (2007) developed the Task Model (see Figure 2.6 below) for mobile learning by using the socio-cognitive engineering design method. The Task Model, which was a derivative of the European Union MOBIlearn project, attempted to satisfy the following requirements of a mobile learning theory:

1. “needs to incorporate perspectives on group communication/activities and the social dimension of learning.

2. must be able to describe existing activities with current technologies, as well as new emergent activities as a result of introducing new tools.

3. must provide a framework for analysis of activities of learners and ways of understanding how activities relate to goals.” (Taylor et al 2006, pg. 140)

These requirements point to a focus on the activities and tasks needed to support a mobile learning model, therefore the Task Model, took its roots from Activity Theory. But sought to “expand Engestroms model, which fails to resolve the complex interdependencies and dialectic of learning and technology” (Frohberg et al 2009, pg. 309).

The task model makes the assumption that learners would enter the learning space with an objective of leaving with a new set of knowledge and skills (Taylor et al 2006). Essentially, learners would select mobile devices or apps that, would enable and integrate into their learning activities, thereby creating a dialectical relationship between technologies and the learning space.

In order to facilitate the required dialectic relationship, the Task model adapts the original socio-cultural factors at the base of Engestrom’s framework, which according to Frohberg et al (2009) are often not considered in traditional classroom environments, but were found to be applicable for mobile learning. As such, Taylor et al (2006) identified the key influencing factors of control, context and communication as a fitting adaption for the mobile learning environment, as can be seen in Figure 2.6 below.

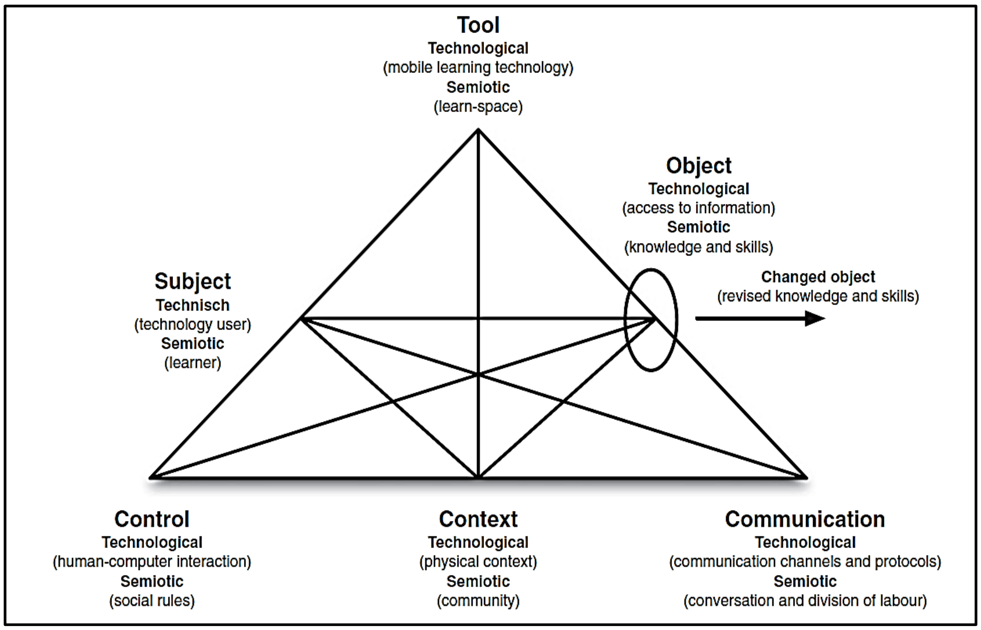

Figure 2.6 The Task Model for Mobile Learners
Source: Taylor et al (2006), Sharples et al (2007)

In terms of context, where learning takes place, Taylor et al (2006) identified two important elements of context, the technological and human, semiotic context. Chung et al (2019, pg. 2-3) suggests "that context awareness is an important factor of mobile learning". For instance, an independent context (Frohberg et al 2009), where mobile devices are used to access learning materials is less effective than the social context (Frohberg et al 2009), which follows the principles of social constructivism.

The context of learning is closely linked to control, which "reflects on the responsibility of the teacher or learner for setting the right target and a meaningful process of learning" (Frohberg et al 2009, pg. 317). Furthermore, Sharples et al (2007) suggests that control can reside with one person, for instance the teacher. Frohberg et al (2009) describes this situation as full teacher control, where the learner follows the teacher directions. On the other hand, the learner can be in full control, an affordance derived from the use of mobile technology. But this can be a dangerous practice in the mobile learning space, since learners may become overstrained, frustrated, directionless and disconnected from the learning community (Frohberg et al 2009). As a result, it is imperative to find the right level of control when designing mobile learning activities. Based on the concept of social constructivism, this calls for the use of sufficient scaffolding (Chung et al 2019), so as to avoid learners passively producing the learning outcomes based on the mobile learning activities.

Communication "indicates the social setting in mobile learning activities" (Chung et al 2019, pg. 3) and hence plays an important role in the learning process, since it facilitates interaction amongst a learning group, a key necessity for scaffolding. In addition, collaborative learning becomes a reality as mobile technologies can offer several channels of communication (Frohberg et al 2009). For instance, learners can collaborate with each other using emails, instant messaging, text messaging, telephone conversation (Sharples et al 2007). Once social interaction is encouraged through the design of relevant mobile learning activities, it results in deeper learning stemming from the learners' reflective process (Frohberg et al 2009).

In yet another framework for mobile learning, the Framework for the Rational Analysis of Mobile Education (FRAME), like the Task Model, is also based on the social constructivist learning theory of Vygotsky (1978) and the activity theory. Ideally, taking into consideration both the technical aspects of mobile devices and the social aspects of learning (Koole 2009).

The key assumption of the model is that mobile devices are not simply an artefact, but "is an active component in equal footing to learning and social processes" Koole (2009, pg. 26).

The FRAME model presents three aspects of mobile learning, 1. The learner aspect (L), 2. The device aspect (D) and 3. The social aspect (S) as seen in Figure 2.7 below.

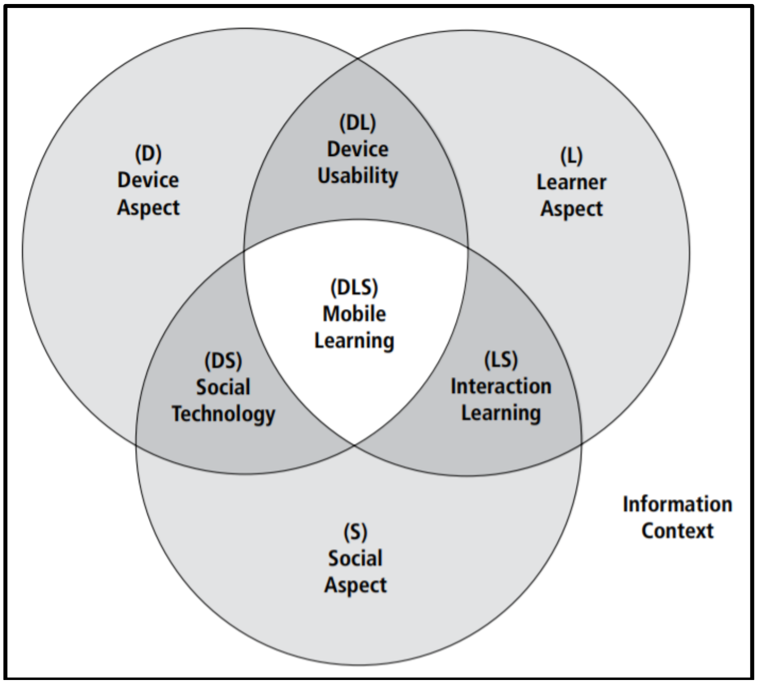

Figure 2.7 The FRAME Model
Source: Koole (2009, pg. 27)

Given this arrangement in a Venn Diagram, the model seek to combine these aspects and specify the common attributes of these aspects through the intersection. For instance, the attributes of device usability are formed by overlapping concerns of the learner (learner aspect) about the device (device aspect). The model, therefore proposes three secondary intersections; device usability (DL), social technology (DS) and interaction learning (LS) and one primary, that represents the ideal mobile learning (DLS). These intersections provide the implications for mobile learning, as such the author would indulge in a brief discourse.

The device usability (DL) intersection relates to the learner's ability to comfortably and satisfactorily complete a learning task based on the characteristics of the mobile device such as physical, input and output capability, storage and processing performance.

The Social Technology (DS) intersection "describes how mobile devices enable communication and collaboration" Koole (2009, pg. 34). The learner should be able to connect and share information, experiences and engage in a community of practice.

The Interaction Learning (LS) deals with designing the interaction among learners, as such LS involves a "synthesis of learning and instructional theories" (Koole 2009, pg. 36). It hinges on the basis that learning is collaborative and takes into account the ZPD as postulated by Vygotsky (1978). In summary, the FRAME model provides a framework that can be used to design a mobile learning pedagogy based on the three aspects discussed above.

The FRAME model has been extended by Kearney et al (2012) to include understandings of mobile pedagogy and focus on the learner's experience. So, much of the FRAME model holds true in Kearney et al (2012) model, except for the identification of three distinctive characteristics as seen in Figure 2.8 below.

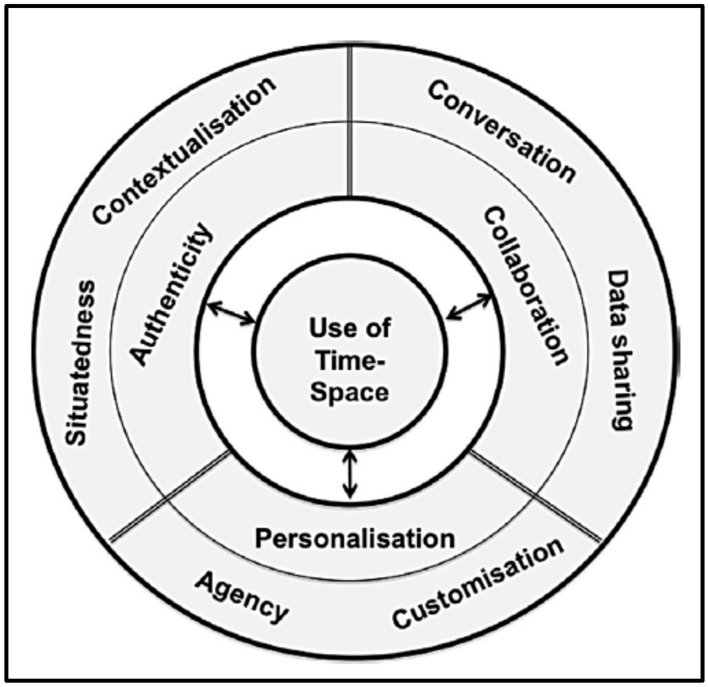

Figure 2.8 Three distinctive characteristics of M Learning Experience
Source: Kearney et al (2012, pg. 8)

Kearney et al (2012) identified authenticity, collaboration and personalization as the three distinctive characteristics of creating an effective mobile learning experience in the inner layer and the six sub-scales (two for each characteristic) in the outer layer.

Essentially, the authenticity characteristic provides the basis for situated learning in a contextual environment, collaboration provides the learning interactions built on Vygotskian theory creating scaffolding, dialogue and conversation. Lastly, personalization brings to the mobile learning experience the opportunity for learners to enjoy control over time, space, place and pace of learning as well customization through use of mobile devices and activity.

This framework, like the FRAME model provides not only a guide for practitioners to design effective mobile learning experiences but also to "interrogate their own M Learning design"

(Kearney et al 2012, pg. 14), since it can be used to critique the pedagogical impact of such design.

Whilst Activity Theory (AT) can be applied to mobile learning as a pedagogical foundation as reviewed above, Cochrane (2014, pg.72) agreed with “Pachler, Bachmair and Cook’s (2010) critique that activity theory is too object oriented and too difficult to operationalize in practice”. In addition, whilst Cowan and Butler (2013) advocates that AT has strong links to constructivist learning, which is further concurred by Taylor et al (2006), the application of AT model in mobile learning can lead to teacher-led mobile learning experiences (Cowan and Butler 2013, pg. 2), as teachers may be reluctant to consider the views of constructivism in a technology enabled environment due to loss of control and potential for disruptive communication.

Furthermore, Cowan and Butler (2013, pg. 3) emphasized the failure of Engestrom (1999) third generation AT to capture the collaborations of both teacher and student concurrently because of the need to switch focus among the subjects i.e. teachers and students, as each would be represented as an independent application existing in parallel as seen in Figure 2.9 below.

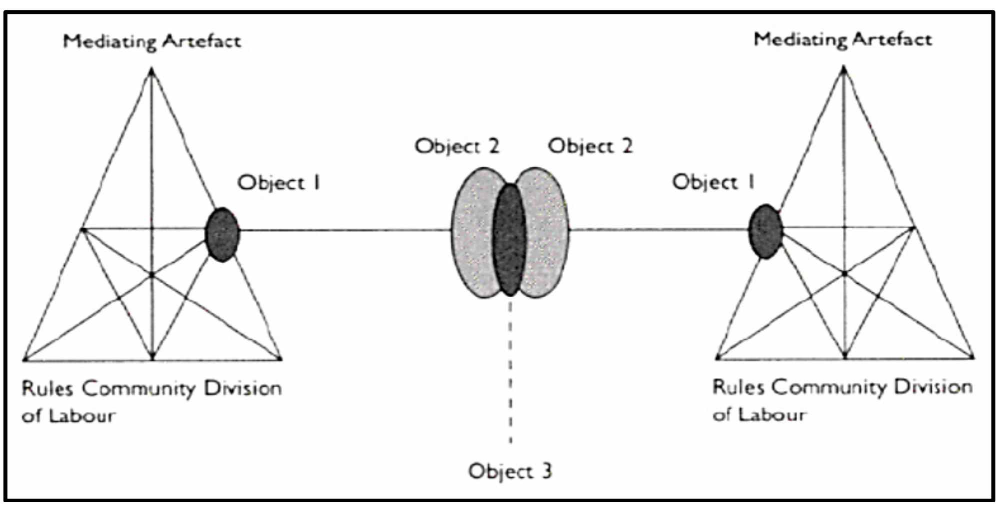

Figure 2.9 Third Generation Activity Theory (Engestorm 1999)
Source: Daniels (2001, pg. 92)

Therefore, an alternative and complementary view, according to Taylor et al (2006), Froberg et al (2009) and Cochrane (2014) is the theory of learning as a conversation developed by Pask (1976) and the Conversational Framework by Laurillard (2002). Since it shifts the focus of learning from the "activity" of interacting with a mobile device to the conversation and cooperation with peers and teachers (Taylor et al 2006). This critique of Activity Theory is line with Daniel's (2001, pg. 135) view, who suggested that an issue which should be developed and researched post-Vygotsky is that of the inherent "lack of theory of structure of discourse as a cultural artefact".

2.3.2 Conversational Theory

Sharples et al (2007, pg. 225) in their definition of mobile learning, suggested that conversational learning is fundamental to the learning process facilitated through interaction with technologies. However, Laurillard (2009, pg. 6) stated that their "theoretical statement privileges interactive technologies. Because it does not embrace both mobile learning and current theories of classroom or workplace learning". Therefore, in order to further understand the concept of mobile learning as a conversational process, it is necessary to explore the principles on which it is premised, that is, Conversation Theory (CT). Since, "it is possible to use the education theories already developed about what it takes to learn" (Laurillard 2009, pg. 5) to exploit mobile technology.

Conversation Theory is based on the work of Gordon Pask, who draws upon a variety of approaches including the ideas from Vygotsky (1978), Mead (1934) and Luria (1961). In addition, as stated by Pask (1976, pg. 13) CT "draws on ideas from the fields of artificial intelligence and computer-aided instruction". Pask (1976, pg. 12) further stated that "the fundamental unit of investigating complex human learning is a conversation involving communication between two participants in the learning process". In other words, the learning process requires the learner and the teacher to be in conversation with one another (Scott 2001, pg. 351). Moreover, this suggest that the theory of learning as a conversation is relevant to both the traditional learning space and the technology enabled learning space. Since Pask did not distinguish between people and interactive systems (Naismith et al 2004), such as those available through mobile technologies.

Pask (1976) postulates that in order for a conversation to be initiated the learner must be able to express an account of themself and their actions. Further, Pask conversational theory suggest that in order to learn, learners must have an internal conversation as well as converse with other learners by sharing their descriptions of the world.

In order to further understand the concept of a conversation between the learner and the teacher about a topic, it is necessary to explore Pask (1975) model of the "skeleton of a conversation" as seen in Figure 2.10 below. In the model, the horizontal connections represent the conversational exchanges between the learner and the teacher, which is referred to as provocations by Pask (1975) "that are designed help the participants construct knowledge and come to know" (Scott and Bansal 2014, pg. 1401). These conversations according to Scott (2001) consist of two logical levels, that is, the lower level 'how' and upper level 'why'. In the latter level, the teacher focuses on the demonstration of concepts and how to construct and recognize them, whereas in the upper level, the teacher is concerned with explaining or justifying the need to construct and apply the concepts (Buchinger and Scott 2010, pg. 111).

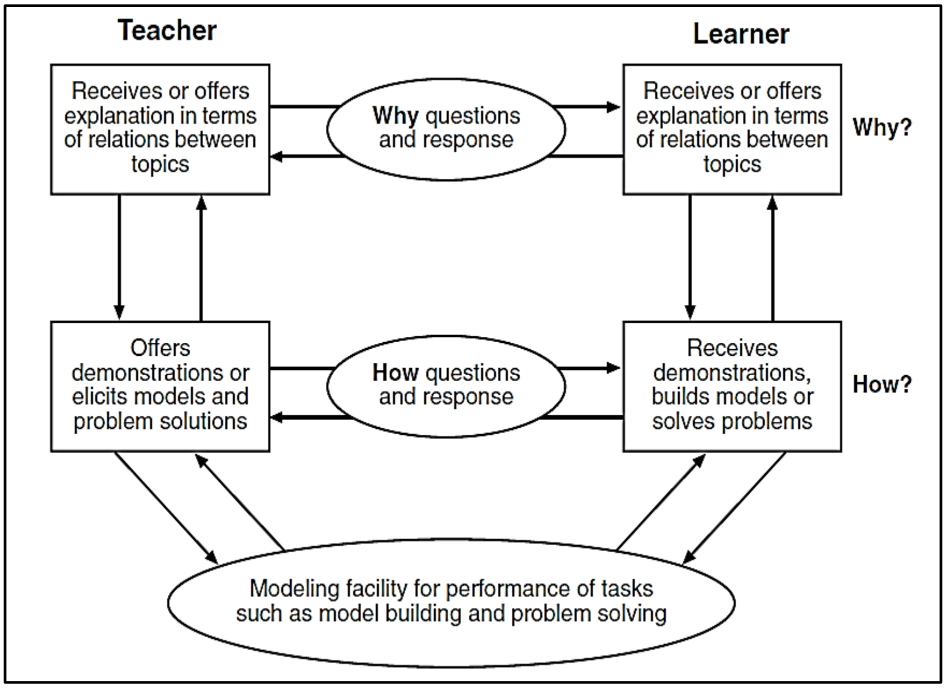

Figure 2.10 The "skeleton of a conversation" Pask (1975)
Source: Scott (2001, pg. 352)

Under conversational theory, effective learning according to Pask as explained by Scott (2001, pg. 353) involves the learning of both the 'why' (comprehension learning) and the 'how' (operation learning). More importantly, Pask (1976, pg.15) suggested that "understanding depends on the ability to reconstruct the concept", in other words the learner must be able to "Teachback" the topic. Essentially, learners demonstrate understanding by providing explanations and sharing descriptions of 'how' and 'why' to other learners and teachers through mutual conversations (Taylor et al 2006), that is to say that "learning develops through agreements between participants" Pask (1976, pg. 14). Furthermore, Sharples et al (2007) concurs with the view held by Pask that learning is a cyclical, continuous exchange of concepts between the learner and teacher and over time as expressed by Pask (1976, pg. 13) "it is no longer possible to make a clear distinction between learner and teacher" since the learner becomes the teacher to other learners, this reciprocal effect allows the teacher to understand how the students learn (Buchinger and Scott 2010, pg. 111).

This theory has been extended further by Laurillard (2002) who developed the Conversational Framework. According to Scott (2001, pg. 353) Laurillard "distinguishes a domain of exchanges of descriptions, conceptions and misconceptions about both the how and why". Laurillard (2012) postulated that the conversational framework represents the dialogues and interactions, which were derived from social constructivism pedagogic approaches, that are necessary between teachers and learners in order to fulfil the requirements of the learning process. The framework, can be seen in Figure 2.11 below, which identifies four (4) learning processes, namely the teacher's conception, teacher's constructed environment, student's conception and student's action. The conversational framework also embodies twelve (12) teaching and learning activities shown as arrows, therefore these activities establish the dialogic relationship between the teacher and learner in an iterative fashion (Laurillard 2002).

Furthermore, Heinze et al (2007, pg. 111) purports that the "student has the opportunity to communicate with the teacher. The teacher, in turn, has the opportunity to evaluate the student's understanding at an early stage and correct it if there are any misconceptions". In essence, the framework requires the teacher and learner to iterate through a cycle of learning activities that encourages conceptions, descriptions, actions, feedback and reflection in light of the experience of practice (Laurillard 2002).

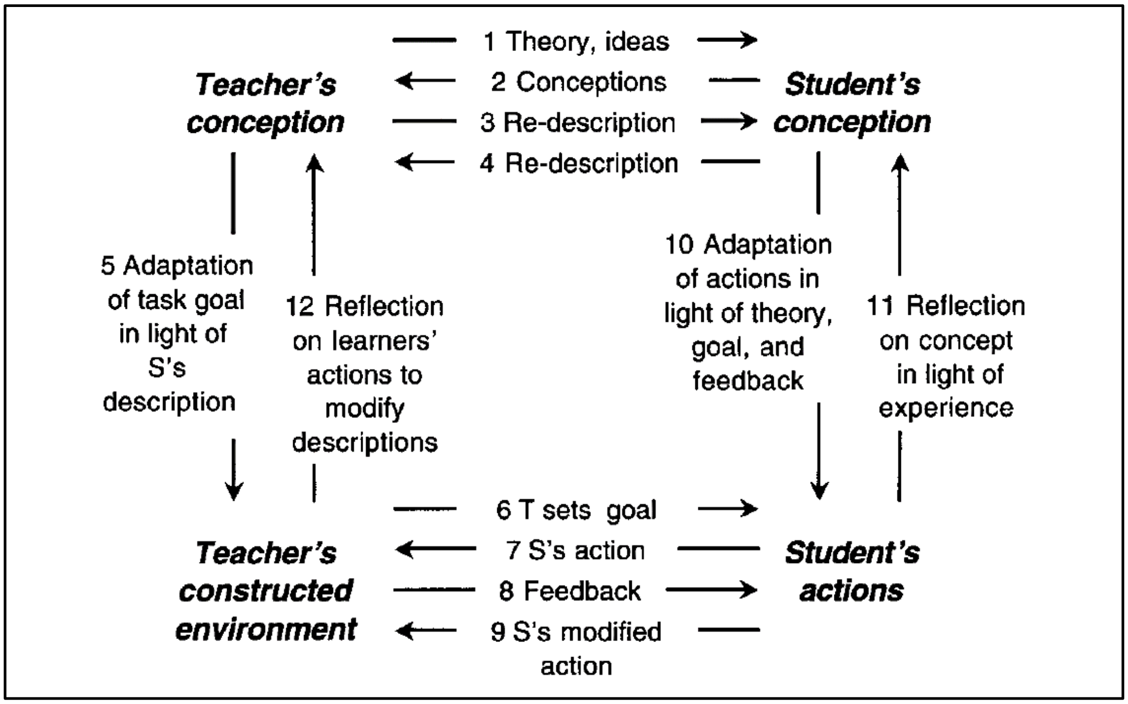

Figure 2.11 The Conversational Framework
Source: Laurillard (2002, pg. 87)

In addition, as elucidated by Laurillard (2002) the framework was designed as a way of challenging the use of new technologies for designing teaching and learning strategies based on the principles defined by the theories of learning. The intention of the framework is to support the requirements for learning through acquisition, practice, discussion and discovery by designing an appropriate teaching strategy using digital technologies. Laurillard (2002, pg. 77) defined a teaching strategy "as an iterative dialogue between teacher and student focused on a topic goal". It is this iterative relationship between the teaching method and learning activity that Laurillard (2012, pg. 93) suggest to be important for instructional design as she expounded "this is where the pedagogical power of digital technologies lies".

In order to understand the implications that digital technologies, have on education, in other words, teaching and learning, Laurillard (2002, pg. 83) sort to classify educational media in terms of "the extent to which they support the interpersonal and internal dialogue". This dialogue (teaching strategy) has been grouped into four aspects, namely the discursive, adaptive, interactive and reflective. Moreover, by extension a range of digital technologies can be applied to support the requirements for learning and the progressive dialogue defined by the learning activities in the conversational framework as seen in the Figure 2.12 below. Therefore, there are implications regarding the use of mobile technology for designing the teaching and learning activities to support the requirements for learning based on the conversational framework.

Learning through	*Conventional technology*	*Digital technology*
Acquisition	Reading books, papers; Listening to teacher presentations face-to-face, lectures; Watching demonstrations, master classes.	Reading multimedia, websites, digital documents and resources; Listening to podcasts, webcasts; Watching animations, videos.
Inquiry	Using text-based study guides; Analyzing the ideas and information in a range of materials and resources; Using conventional methods to collect and analyze data; Comparing texts, searching and evaluating information and ideas.	Using online advice and guidance; Analyzing the ideas and information in a range of digital resources; Using digital tools to collect and analyze data; Comparing digital texts, using digital tools for searching and evaluating information and ideas.
Practice	Practicing exercises; doing practice-based projects, labs, field trips, face-to-face role-play activities.	Using models, simulations, microworlds, virtual labs and field trips, online role-play activities.
Production	Producing articulations using statements, essays, reports, accounts, designs, performances, artifacts, animations, models, videos.	Producing and storing digital documents, representations of designs, performances, artifacts, animations, models, resources, slideshows, photos, videos, blogs, e-portfolios.
Discussion	Tutorials, seminars, email discussions, discussion groups, online discussion forums, class discussions, blog comments.	Online tutorials, seminars, email discussions, discussion groups, discussion forums, web-conferencing tools, synchronous and asynchronous.
Collaboration	Small group project, discussing others' outputs, building joint output.	Small group project, using online forums, wikis, chat rooms, etc. for discussing others' outputs, building a joint digital output.

Figure 2.12 Types of Learning and the Different Types of Conventional and Digital Technologies
Source: Laurillard (2012, pg. 97)

In terms of learning through acquisition, in which the learner plays a passive role since the teacher is simply transmitting knowledge by explain the concepts or topic. The learner is acquiring the knowledge by “listening to presentations and podcasts, reading books and digital resources and watching demos and videos” (Laurillard 2012, pg. 107). Various mobile technologies can facilitate this process, for instance teachers can upload their lectures and handouts, links to useful videos and tutorials to a web based learning management system that students can access through a mobile application. This encourages self-directed learning as purported by Sharples et al (2005).

With regards to learning through inquiry, the learner has more control of the information and concepts related to the topic presented, since they can determine the path and order in which they interact and investigate the suggested the learning material. For instance, teachers can direct the learners to digital resources by providing a reading list of eBooks. This can be implemented through the use of mobile technology in the form of QR codes, whereby links to additional resources, solutions to problems, book reviews and short videos can be provided. Essentially, this form of learning encourages learners to be more active and give them “a greater sense of ownership of their learning” (Laurillard 2012, pg. 107).

In addition, learning through practice occurs when the learner essentially translates their conceptualization of a topic into practice. This is done in order to achieve a task goal set by the teacher and therefore provides the student with the opportunity to reflect on the experience, ultimately constructing new meaning to the concepts taught (Laurillard 2012). Mobile technology can provide this affordance by delivering opportunities to practice through the use of games, augmented and virtual reality apps, quizzes and worksheets delivered to a mobile device. Critical to the effectiveness of using mobile technology, is its ability to provide worthwhile intrinsic feedback to the learner so that experiential learning and constructionism can take place.

Although, the conversational framework is primarily concerned with the application of educational technology to higher education and can be applied to a range of topics or contexts (Taylor et al 2006), it is not widely used in practice as stated by Heinze and Heinze (2009, pg. 296). In addition, the conversational framework has been challenged by Draper (1997 cited in Heinze et al 2007, pg. 112), who suggested "that there is a lack of attention to the management of learning and the need for learning negotiation between the student and the teacher".

Subsequently, Laurillard (2002, pg.159) acknowledged the need for further research into student-student learning as "this is a field of research that has yet to produce a practice oriented consensus on how we should support student-student dialogue". In light of this, Laurillard (2009, pg. 6-8) recognized the learners' peer as an important actor to fulfilling the formal learning process and therefore advocated for a pedagogical framework that utilized digital technology for collaborative learning. As such, two further learning processes were added to the framework, that is, Other learners' conception and Other learners' conception as practice. This essentially, "enables them to learn from and build on the outputs of their peers, and to share their reflections and interpretations of what happened within their practice" Laurillard (2009, pg. 10). This is shown in Figure 2.13 below as the Peer communication cycle and the Peer modeling cycle.

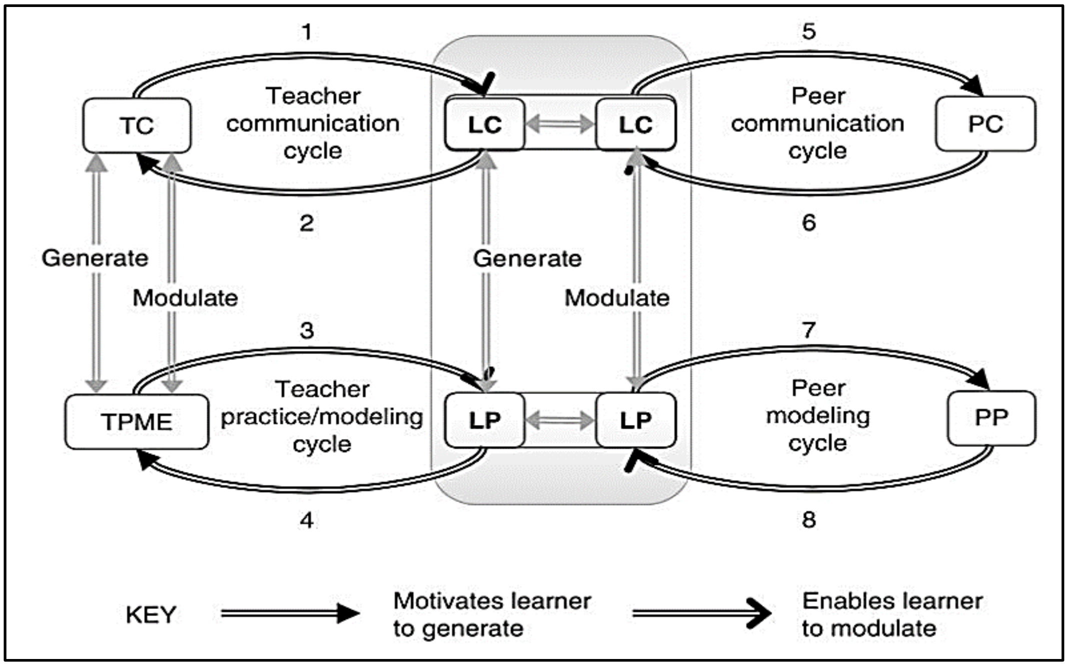

Figure 2.13 The Learner Learning through interactions with peers'
Source: Laurillard (2012, pg. 92)

These additional cycles or processes facilitates learning through discussions and collaboration, which are both aligned to the social constructivist pedagogy purported by Vygotsky (1978). However, learning through discussion can be distinguished from learning through collaboration (Laurillard 2012). On the one hand, learning through discussion involves the use of group discussions, seminars and tutorials, which is carefully setup by the teacher "in the form of a question or issue" (Laurillard 2012, pg. 98). Essentially, it will take some form of meaningful peer discussions, which, as elucidated by Marcarelli (2010, pg. 134) "allows students to express their ideas, hear and build on the ideas of other students, and reconsider and revise their own ideas".

On the other hand, learning through collaboration require the learner not only to be involved in meaningful peer discussions, but to also share their outputs from practice with other learners so as to fulfil the task goal of a joint product (Laurillard 2012). Furthermore, Osman (2011, pg.

547) expounded that learners must be able “to articulate their perspectives and to resolve differences in understanding”. This view is also held by Laurillard (2009, pg. 10), who stated that collaborative learning “enables them to learn from and build on the outputs of their peers and to share reflections”. These are the critical aspects of an effective and valuable collaborative learning environment.

Mobile technology can be used to augment conventional methods of stimulating peer discussions. For instance, lecturers can setup an online discussion forum that exploits the use of instant messaging feature on mobile devices by using specific mobile apps such as WhatsApp. This allows students to have discussions not only in a formal education environment but outside of the classroom as well as without the lecturer. Additionally, the use of Google G Suite for Education can be used to provide capability of document sharing as it is a cloud based service. This allows students to work on group projects whether offline or online via mobile devices.

Having reviewed the underlying theory and models of mobile learning, it is now important to provide a synopsis so as to identify the implications for the research. This will be revealed in the next section.

2.3.3 Summary of Mobile Learning Theories

Essentially, the theories of mobile learning “have begun to converge around some key features of the devices, environments where learning occurs, and the learning processes each affords” (Bernacki, Crompton and Greene 2020, pg. 1). The implications of these models for mobile learning are that several factors or requirements must be considered and met. These include but are not limited to; interaction, collaboration, communication and authentic learning in developing a mobile pedagogy. Furthermore, the models reviewed also take into account that mobile technology provides an opportunity for informal learning as well as the needs of learners and their unique culture and situatedness.

It is clear that the current models for designing a mobile learning environment are built on Vygotsky's (1978) social constructivism theory of learning, that is, it is based on the tenants of social and cultural processes of learning (Crompton, 2017). Therefore, there is a great deal of commonality and similar notions amongst them. In other words, “mobile technologies provide learning environments which align with the ideas about the practice of constructivism in education” (Lai et al 2016, pg. 538). This view is shared by Naismith et al (2004, pg. 36) who stated that the “challenge for the educators and technology developers of the future will be to find a way to ensure that this new learning is highly situated, personal, collaborative and long term; in other words, truly learner-centred learning”.

In essence, it is therefore critical for the researcher to evaluate the learners’ preference towards a constructivist mobile learning environment because their preference “should be perceived as a crucial foundation for the further development of the environment” (Tsai 2008, pg. 17). In other words, the researcher contends that evaluating the learners’ preference in constructivist mobile learning environment is a key step to understanding how mobile learning can be used to augment the pedagogical strategies currently used in private sector higher education. Moreover, the design of a learning environment should accommodate for individual differences and more importantly, the fulfilment of learners’ preference (Tsai et al 2012, pg. 250). Furthermore, Tsai et al (2012, pg. 252) posits that “few studies have explored this issue”, therefore, the researcher is not only interested in their preference but also the extent to which their preferences for a constructivist learning environment will affect their intentions to adopt mobile learning. This is critical to the research since attempting to integrate learning preference into the design of a mobile learning environment must be done from an informed position (Cassidy 2004, pg. 420).

Consequently, at this juncture it is necessary to delve into the concept of learning style and learning preference since it is considered “one of the important elements correlated with the quality of teaching and learning” (Lai et al 2016, pg. 537). In addition, the subsequent section will review the framework for constructivist mobile learning environment preferences.

2.4 Learning Style and Preferences

In essence, learners will inevitably process and internalize the information they receive from their teachers based on the pedagogy used. This view is substantiated by Felder and Silverman (1988, pg. 674) who opined that learning is a two-step process, involving the reception and processing of information, where ultimately students will choose what to process and ignore the irrelevant information. In addition, Pritchard (2013, pg. 46) stated that “we learn in different ways from one another and we often choose to use what has become known as a preferred learning style”. Similarly, Jonassen and Grabowski (1993 cited in Gulbahar and Alper 2011, pg. 271) emphasizes that a student’s learning style is based on their preference to process information in certain ways. Keefe (1985, pg. 138) concurs with this view, suggesting that learning style “indicates how a student learns best”, but more importantly, noting that “learning style has cognitive, motivational and physiological elements” which determines how a student will interact with their learning environment.

According to Cassidy (2004) cognitive style is one of the most critical components of learning style. This view originates from Riding and Cheema (1991) who posits that a learning style is embraced to reflect the cognitive style of a student in a learning environment, where the cognitive style refers to “a certain approach to problem solving, based on intellectual schemes of thought” (Pritchard 2013, pg. 46). In effect, making learning style a subset of cognitive style (Rayner and Riding 1997).

So essentially, the key point from the discourse above is simply that a student’s learning style represents their preferred intellectual approach to learning (Pritchard 2013, pg. 47). In addition, Dunn (1984, pg. 12) suggested that the learning preference will be different for each individual student. This proposition has emerged as a key pedagogical issue for teachers (Hawk et al 2007), since awareness of students’ learning style “should help teachers to a better understanding of the needs of learners” (Pritchard 2013, pg. 47). Thereby, allowing teachers to unify their teaching style with the preferred learning style of students in a manner that will enhance the learning process.

In the context of this research, this is a critical issue as the research poses in essence, the question of how to augment the existing pedagogical strategies with mobile learning in private higher education. Thus, it is essential to understand the typologies of the student’s individual differences and learning preference. Since, doing so would allow teachers to make a more informed decision on the range of teaching approaches and learning activities that can be used to ensure effective learning. But more importantly, it will ensure that the needs of learners are satisfied through the design of an appropriate mobile learning environment. Hence, it is the researcher’s position that the learners’ preference will affect intentions to adopt mobile learning. Therefore, the subsequent section will address the various models of learning styles that have been developed by various authors over the years.

2.4.1 Traditional Learning Style Models

The importance of learning style awareness for teachers and more so higher education institutions when designing learning environments should not be underestimated. Since, congruence between teaching methods and students preferred learning style lead to stronger levels of student performance (Dunn 1984, pg. 12-13). Felder and Silverman (1988, pg. 680) concurs with this view by stating that "mismatches lead to poor student performance, professorial frustration, and a loss to society". In other words, the lack of synergy between the students' learning preference and teaching style often lead to negative student experiences resulting in lower motivation and student engagement, poorer academic performance and ultimately student attrition.

Whilst there are a number of learning style models, Kolb (1984), Honey and Mumford (1986) and Felder and Silverman (1988) remain the prominent and widely used models in educational research to assess how students learn.

Kolb's (1984, pg.41 cited in Kolb and Kolb 2006, pg. 47) Experiential Learning Theory (ELT), defines learning as "the process whereby knowledge is created through the transformation of experience". The ELT, which was based on ideas from John Dewey, Kurt Lewin and Jean Piaget and others, therefore proposes a constructivist learning environment (Kolb and Kolb 2006, pg. 47; Scott 2001, pg. 349). The learning process is hypothesized as a four stage cycle (Hawk and Shah 2007), where individual students may prefer or cope better with some stages than others in the cycle (Cassidy 2004). In addition, Duff and Duffy (2002, pg. 148) stated that "the hypothesized learning cycle can be entered at any stage but must be followed in sequence", since under ELT, learning is continuous and interactive process (Cassidy 2004; Hawk et 2007).

The four stages described by Kolb (1984) in the learning cycle (see Figure 2.14 below) are focused on “the polar extremes of the concrete-abstract and active-reflective dimensions of cognitive growth” (Allinson and Hayes 1990, pg. 859). This is so, since according to Kolb (1984 cited in Kolb and Kolb 2006, pg. 47) “knowledge results from the combination of grasping and transforming experience”. As such, the ELT purports two orthogonal bipolar dimensions of learning. Firstly, the prehension dimension (concrete experience – abstract conceptualization), which involves grasping information from experience and secondly the transformation dimension (Reflective Observation - Active Experimentation), which involves the processing of the information grasped (Duff and Duffy 2002).

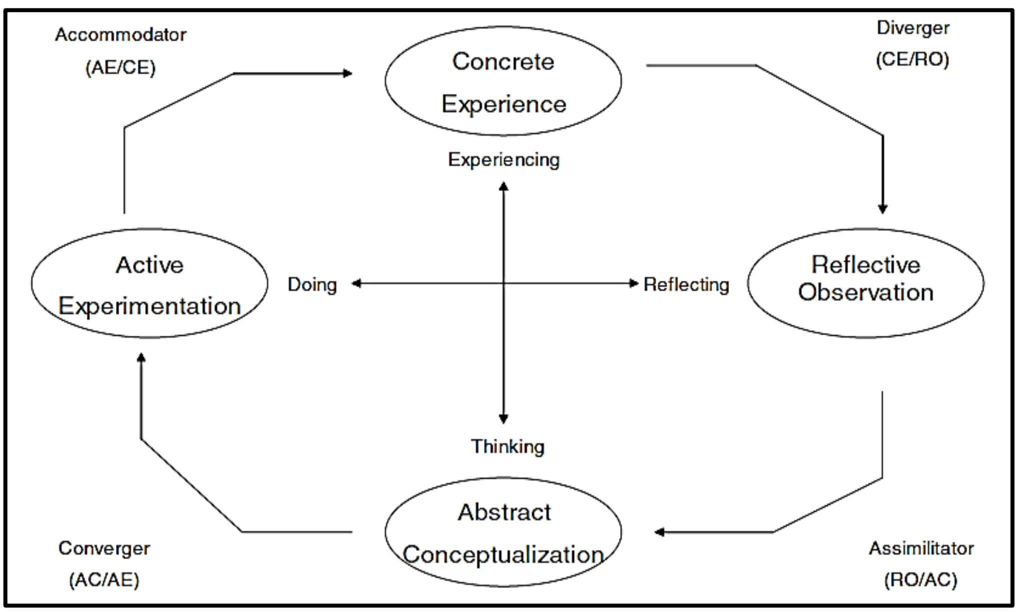

Figure 2.14 Kolb’s (1984) Experiential Learning Model
Source: Hawk and Shah (2007)

Therefore, the model portrays four modes or stages of learning, that ideally starts with concrete experience (CE- experiencing), where the learner acquires new information (Duff and Duffy 2002), which leads to reflective observation (RO- reflecting) on that experience, allowing the learner to organize the experience. The third stage involve abstract conceptualization (AC- thinking), whereby the learner utilizes the reflection to form generalizations based on analytical thinking of the experience in order to achieve understanding (Cassidy 2004). This leads to the fourth stage, active experimentation (AE- doing), which involves the learner testing the knowledge conceptualized in practice so as to modify the next set of actions (Duff and Duffy 2002).

Kolb and Kolb (2006) advocated that learning is a process that involves creative tension among the four modes. That is to say, in an idealized cycle the learner will move through all four modes; experiencing, reflecting, thinking and doing in a recursive manner (see Figure 2.15 below) based on the learning situation, which leads to increasing knowledge.

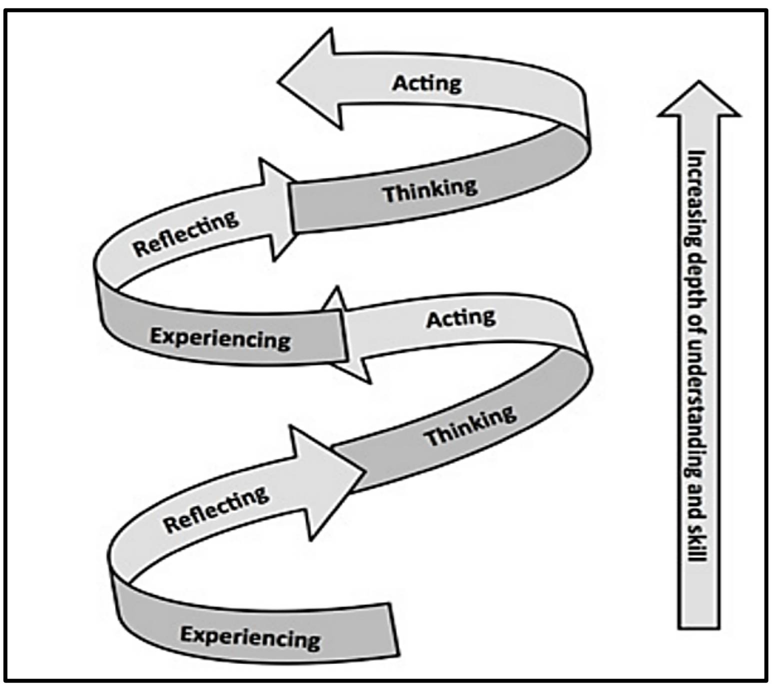

Figure 2.15 Experiential Learning Spiral
Source: Kolb and Kolb (2018, pg.9)

ELT initially proposed four learning styles based on the combination of two adjacent mode preferences (Hawk and Shah 2007, pg. 3), that lie on the two dimensions of learning (Pritchard 2013), that is, the prehension dimension and the transformation dimension. The four learning styles defined in Table 2.2 below are; Diverger (CE and RO), Assimilator (RO and AC), Converger (AC and AE), and Accommodator (AE and CE).

Learning Style	Description
Diverger	Have a strong imaginative ability, are good at seeing things from different perspectives, are creative, and work well with people.
Assimilator	Have abilities to create theoretical models, prefer inductive reasoning, and would rather deal with abstract ideas
Converger	Have a strong practical orientation, are generally deductive in their thinking, and tend to be unemotional
Accommodator	Like doing things, are risk takers, are in the here and now, and solve problems intuitively

Table 2.2 Kolb's Learning Style Description
Source: Hawk and Shah (2007, pg. 4)

Furthermore, the two dimensions of learning was derived from Kolb's (1976) Learning Style Inventory (LSI) (Duff and Duffy 2002), which is used to evaluate the preferred relative positions of students on the two bi-polar dimensions. According to Cassidy (2004, pg. 431) the LSI was initially developed as a 9-item scale (Kolb 1976) and then modified the LSI to a 12-item scale (Kolb 1985) due to the criticisms the initial LSI received. Basically, the methodology of the LSI requires respondents for each of the twelve items to rank-order four sentence endings that match to the four learning modes. The result is an LSI score for each of the four learning modes, that emphasizes the student's relative position for that mode of learning (Cassidy 2004). These scores are then transferred to learning style profile, which then facilitates identification of a dominant style of learning that resolves the tension among the four modes of learning.

There have been many critics of Kolb's LSI, evident by the numerous research on the validity and reliability of the instrument (Hawk and Shah 2007; Cassidy 2004). For instance, Allinson and Hayes (1990) stated that concerns were raised regarding the LSI's instrument internal consistency, temporal stability and construct validity as evident by research carried out by Carter (1983), Freedman and Stumpf (1978) and Geller (1979) cited in Allinson and Haynes (1990). In addition, Duff and Duffy (2002, pg. 148) highlighted the issue of confirmatory factor analysis indicating that "the ipsative scoring method guarantees that some scales must be negatively correlated". Similar issues were also raised regarding Kolb's (1985) version of the LSI, for example Allinson and Haynes (1990) suggested that based on the work of Atkinson (1988) the LSI is perhaps more vulnerable to response bias. Furthermore, Duff and Duffy (2002) purported that the use of the LSI was premature because its psychometric properties had not been adequately evaluated.

Since then and in response to the many critics, the LSI has been revised two further times, LSI 3.0 and LSI 4.0 in 1999 and 2011 respectively. Interestingly, the LSI 4.0 now defines nine learning styles (see Figure 2.16 below), based on the concepts of Abby, Hunt, and Weiser (1985) and Hunt (1987) cited in Kolb and Kolb (2005, pg. 197), whereby the normative distributions for AC–CE and AE–RO are divided into thirds instead of halves in the previous versions.

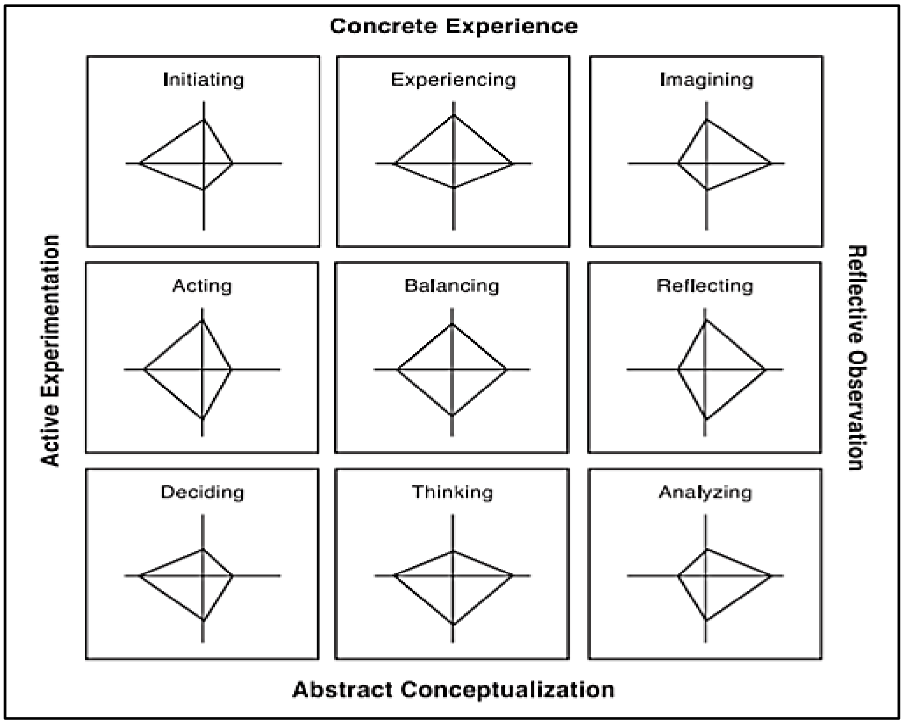

Figure 2.16 The Nine Learning Styles in Kolb's LSI 4.0
Source: Kolb and Kolb (2017, pg. 23)

An alternative to Kolb's LSI is Honey and Mumford (1992) Learning Style Questionnaire (LSQ), which was initially developed for management trainees, but has subsequently been used in many other contexts including higher education (Duff and Duffy 2002). Furthermore, according to Cassidy (2004) ELT forms the basis for the development of the LSQ since the four learning styles that Honey and Mumford (1992) suggested that students need to adopt to complete a learning activity corresponds to the stages of the Kolb's learning cycle (Allinson and Hayes 1990). The four learning styles defined by Honey and Mumford (1992) are; Activists (Kolb's AE), Reflectors (Kolb's RO), Pragmatists (Kolb's CE) and Theorists (Kolb's AC) see Table 2.3 below for definitions.

Honey and Mumford Learning Styles	Kolb's ELT Equivalent	Description
Activists	AE	Prefer to learn by doing, thrive on novelty, immerse themselves in a wide range of experiences
Reflectors	RO	Prefer to stand back and observe, like to collect as much information as possible, prefer to look at the big picture
Pragmatists	CE	Prefer to adapt and integrate observations into frameworks, work towards adding new learning into existing frameworks
Theorists	AC	Prefer to seek out and make use of new ideas, look for practical implications before making a judgement

Table 2.3 Honey and Mumford's Learning Styles Definitions
Source: Pritchard (2013, pg. 48-49)

The LSQ, is a self-reported questionnaire that contains eighty items using a normative scale, meaning each statement is individually rated by the respondent, unlike Kolb's LSI ipsative scale. In other words, unlike Kolb's LSI which utilize one-word descriptors portraying each learning mode for an item, the LSI "rely on statements of observable behavior with which respondents are required to express broad agreement or disagreement" (Allinson and Hayes 1990, pg. 860). This means that under LSQ, a student preference towards a learning style is based on their ratings of the individual items, which “are behavioural, i.e. they describe an action that someone might or might not take. Occasionally, an item probes a preference rather than a manifest behaviour” (Duff and Duffy 2002, pg. 149).

Although LSQ was purported to be an alternative to Kolb’s LSI, there are concerns with its psychometric qualities (Cassidy 2004). A study done by Allinson and Hayes (1988, cited in Allinson and Hayes 1990, pg. 860) reported that reliability was a little better than that of the Kolb’s LSI and hypothesized two orthogonal dimensions; Activist–Reflector and Pragmatist–Theorist by using exploratory factor analysis (Duff and Duffy 2002, pg. 149).

In yet another study by Allinson and Hayes (1990) using undergraduate UK students, the LSQ was found to be a stable and internally consistent measure of the two independent dimensions. However, in contrast, a study conducted by Duff and Duffy (2002, pg. 152) found that the LSQ scales for the four learning styles have modest internal consistency and “only limited evidence exists to support the hypothesized two learning dimensions and four learning styles” (Duff and Duffy 2002, pg. 156).

In light of these mixed results, Allinson and Hayes (1990, pg. 866) opined “it is still not clear that it provides a satisfactory alternative to Kolb's inventory as a method of assessing learning styles”. Furthermore, Duff and Duffy (2002, pg. 159) study found that “even after modification the LSQ cannot be safely used with samples of UK undergraduate students”. They further stated that the LSQ “is not sufficient to identify students’ dominant learning style or they do not interact with the learning model of higher education”. In summary, it is arguable that both the Kolb’s LSI and Honey and Mumford LSQ are appropriate instruments for evaluating students’ preferred learning style. However, over the years they have been both used in several studies to evaluate the preferred learning style of students.

An alternative to both LSI (Kolb 1984) and LSQ (Honey and Mumford 1992) is the Felder and Silverman Learning Style Model (Felder and Silverman 1988, pg.674), which "classifies students according to where they fit on a number of scales pertaining to the ways they receive and process information". According to Huang et al (2012a, pg. 340-341) it is a more detailed model than Kolb's and Honey and Mumford's, because it provides a more detailed description of the learners' preference. In addition, Kuljis and Liu (2005 cited in Huang et al 2012a) suggested that the Felder and Silverman Learning Style Model (FSLSM) is the most relevant model for e-learning applications. Furthermore, Adkins and Guerreiro (2018) shared a similar view of the appropriateness of the FSLSM, suggesting that student learning attributes are more easily identified and it therefore provides a robust framework for technology enhanced items design.

The original FSLSM described five learning style dimensions: sensory-intuitive, visual-auditory, inductive-deductive, active-reflective, sequential-global (see Figure 2.17 below for definitions). According to Felder and Silverman (1988, pg. 675) the dimension of active-reflection is a component of Kolb's ELT, namely, the reflective observation (RO) and active experimentation (AE) continuum (Huang et al 2012a). Therefore, by extension Honey and Mumford's (1992) learning styles of Activists and Reflectors is similar to the Felder and Silverman's dimension of active-reflection. In addition, the first dimension of sensory-intuitive is based on the work of Carl Jung's psychological types (Adkins and Guerreiro 2018, pg. 579). It is worth noting that Felder's 2002 preface to the original paper Felder and Silverman (1988) articulated that in order to prevent instructors from using the less effective deductive paradigm, because students may prefer it, omitted the inductive-deductive dimension, thereby resulting in four main dimensions today.

Learning Style

Active
I understand information best by doing something active with it - discussing or applying it or explaining it to others

Reflective
I prefer working alone

Sensing
I like learning facts and be patient with details
I am more practical and careful

Intuitive
I prefer discovering possibilities and relationships
I am more comfortable with abstractions and mathematical formulations

Verbal
I get more out of words - written and spoken explanations

Visual
I remember best what I see - pictures, diagrams, flow charts, time lines, films, and demonstrations

Sequential
I follow logical step wise paths in finding solutions

Global
I learn in large jumps, absorbing material almost randomly without seeing connections, and then suddenly getting it

Figure 2.17 Felder and Silverman (1988) Learning Styles Definition
Source: Kamal and Radhakrishnan (2019, pg. 414)

In addition, to learning styles, Felder and Silverman (1988) proposed corresponding teaching styles by grouping instructional methods based on their adequacy to fulfil the learning styles (see Table 2.4 below). According to El-Bishouty et al (2019, pg. 162) the matching "teaching components or elements include concrete-abstract, visual/verbal, active-passive and sequential-global".

Preferred Learning Style		*Corresponding Teaching Style*	
sensory intuitive	perception	concrete abstract	content
visual auditory	input	visual verbal	presentation
inductive deductive	organization	inductive deductive	organization
active reflective	processing	active passive	student participation
sequential global	understanding	sequential global	perspective

Table 2.4 Felder and Silverman Dimensions of Learning and Teaching Styles
Source: Felder and Silverman (1988, pg. 675)

In 1991 Felder and Soloman developed the Index of Learning Styles (ILS) to be used as an instrument to evaluate students' preference towards each of the four dimensions of learning styles as defined by Felder and Silverman (1988). Whereby, each of the dimensions (with two polar scales) contains 11 items, resulting in a 44-item questionnaire. The ILS reports a score on each of the dimension showing the strength of a learners' preference towards a category on the continuum (Hawk and Shah 2007) as seen in Figure 2.18 below. The score can be interpreted as:

- "1 or 3, you are fairly well balanced on the two categories of that dimension, with only a mild preference for one or the other
- 5 or 7, you have a moderate preference for one category of that dimension
- 9 or 11, you have a strong preference for one category of that dimension."

  Felder and Soloman (n.d)

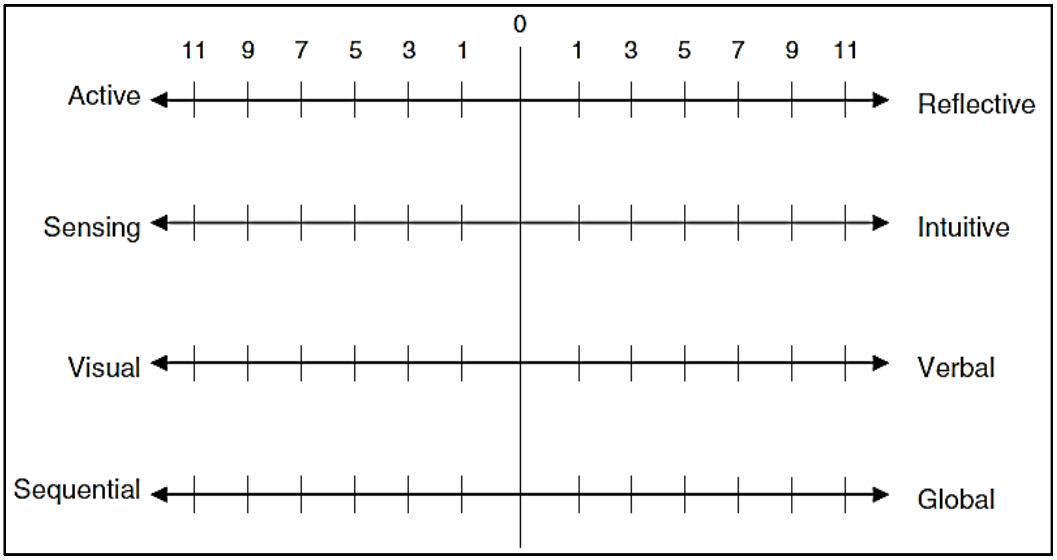

Figure 2.18 Felder and Solomon ILS
Source: Hawk and Shah (2007, pg. 8)

The ILS has been used by many researchers for technology enhanced learning studies (Huang et al 2012a) and has been validated by Felder and Spurlin (2005). However, in an earlier study attempting to compare the ILS and LSQ and its use to predict academic performance, Van Zwanenberg et al (2000) found the ILS scales to have low reliability (alpha = 0.41 to 0.65) compared to the LSQ scales. But, Felder and Spurlin (2005, pg. 111) disputed those findings by stating that as long as the ILS is not used for predicting students' performance, the ILS is considered reliable, valid and suitable to help students understand their learning preference. More importantly, it can help teachers develop an optimal learning environment (Felder and Silverman 1988).

2.4.2 Mobile Learning Preferences

In the context of mobile learning, the role that learning preference plays in influencing usability of a mobile learning environment has not been widely researched (Tortorella and Graf 2017). This view is shared by Karimi (2016, pg. 771) who stated that "there is little known about the influence of learning style on m-learning usage". In addition, Li and Yang (2016, pg. 923) opined that even though the preference towards learning style is known to have an effect on the instruction of students, "their effectiveness in m-learning has not been clarified". In other words, there are a few related studies that utilized learning style as a determinant of designing a mobile learning environment or mobile learning adoption. However, according to Cruz (2013, pg. 510) "the understanding of technology adoption and students' learning styles should be considered to develop effective mobile education". A similar view is held by Lai et al (2016) expounding that it is critical to consider students' needs in order to develop a well-constructed mobile learning environment. Therefore, this section presents a review of the related studies on the use of learning style as a key factor in designing a mobile learning environment and determinant of mobile learning adoption.

Huang et al (2012b) presented an Adaptive Mobile Learning System (AMLS) that sought to provide students with an environment that suited their learning capability. An essential element of the AMLS architecture included a learning style diagnosis, which was done using the Felder and Silverman Learning Style Model (FSLSM). In a similar study conducted by Tortorella and Graf (2017), to propose an approach "for providing mobile, personalized course content tailored to each individual's learning style while incorporating adaptive context awareness". Their results showed a 23% improvement in understanding of the course content and high acceptance of the mobile application and personalized content. In both studies the importance of incorporating the learners' preference proved to be an important influence in creating an AMLS.

Another study, Hsieh et al (2011) also utilized FSLSM, in particular the Active-Reflective dimension to investigate the effects of teaching and learning styles on the reflection levels of students in a ubiquitous learning context. They found that when the ubiquitous learning environment created harmony between the teaching style used and the students' preferred learning style, student reflection levels significantly increased (Hsieh et al 2011). In contrast, Li and Yang (2016, pg. 922) found that "learning styles have no significant effect both on concentration and achievement". Their study examined the effect that learning style and interest has on learning concentration and academic achievement of ninety-two (92) students using mobile devices in a Chinese college classroom. Li and Yang (2016) used the Index of Learning Styles from Felder and Soloman (1997) for evaluating the learning style of students participating in the study.

In yet another study, looking at the relationship between various learners' characteristics and designing a mobile learning environment, Chen (2015) looked at the difference in students learning outcome whilst using mobile Facebook. However, unlike the previous studies reviewed that used Felder and Solomon's learning styles, Chen (2015) investigated the differences using Kolb's four learning styles. Chen (2015) found that students "with Assimilating and Diverging learning styles performed better than those with Accommodating and Converging learning styles".

In addition to researching the effect of learning style (LS) on the design of mobile learning, researchers have also investigated the effect on mobile learning adoption, a key focus of this research. For instance, Cruz et al (2014) in their research sought to understand the influence of learning style on mobile learning acceptance by using Kolb's Learning Styles as a moderator. The findings revealed that there is partial influence of learning style as a moderator for mobile learning adoption as only one of the three moderation effects was found to be significant, i.e.

learning style moderated the influence of effort expectancy on intention to adopt mobile learning ($\beta = 0.443$) (Cruz et al 2014). Similarly, Karimi (2016) found learning style to be an important consideration in developing a mobile learning adoption model. Their research also used Kolb's LSI to evaluate the different learning styles of 130 undergraduate students participating in the study. Karimi (2016, pg. 773) study showed that two learning styles, namely assimilating and accommodating, had a significant effect on mobile learning adoption in both formal and informal learning contexts.

From the literature it is clear that learning styles and preferences have some degree of impact on developing mobile education and mobile learning adoption. The studies reviewed used either Kolb's (1984) LSI or Felder and Silverman's (1988) ILS for measuring learning style preferences, both of which have been purported to be justified and appropriate for technology enhanced learning studies. Case in point, Huang et al (2012a, pg. 341) stated that Felder and Silverman's ILS "has been widely used in the measurement of technology-enhanced learning". In addition, Karimi (2016, pg. 772) stated that Kolb's LSI is a commonly used instrument in e-learning studies and "has important implications in studying learners' ability and willingness to adopt self-directed learning, yet not being examined in m-learning".

Essentially, there are two important gaps that have been illuminated from the above review. Firstly, there is a gap in the literature as it relates to the use of learners' style and preference in predicting mobile learning adoption as there are relatively few studies on this theme and it is a relatively new area of research. Secondly, even though previous studies employed traditional learning style models to investigate the relationship, these models were not initially developed with technology enhanced learning in mind, let alone learning using mobile technology.

Moreover, given that mobile learning is aligned to constructivist theory of learning, the implications for the instructional design necessary for a mobile learning environment must therefore be based on the constructivist lens. Hence, in order to address this theoretical gap in terms of relevance of the traditional learning style models, the researcher took a much broader and conceptual view than the specific learning styles defined by Kolb (1984) and Felder and Silverman (1988), so as to capture the common preferences aligned with constructivism.

In order to derive the implications of a constructivist paradigm to a mobile learning environment, it becomes necessary to review studies that used a constructivist learning environment scale for various technology enhanced learning context. Since according to Yildirim (2014, pg. 3) "these scales have been developed primarily to determine to what extent the constructivist learning approach is applied within the learning environment". These scales will be used as the basis of developing the Constructivist Mobile Learning Preference construct for this research.

2.4.3 Constructivist Mobile Learning Preferences

There are several underlying assumptions and principles of constructivism (see Table 2.5 below), none more important than "knowledge is an active process of construction, not the receipt of information from external sources" (Knuth and Cunningham 1993, pg. 164). In other words, learners must give meaning to the information they received by constructing interpretations through the lens of their prior individual experience and in collaboration with other learners (Beyhan 2013). Fosnot and Perry (2005, pg. 34) agreed with this view, advocating for teachers to allow learners to generate their own questions and hypotheses and to discuss them with the learning community. Similarly, Brooks and Brooks (1999) suggests that the curriculum should be adjusted to support suppositions by the learners.

Knuth & Cunningham (1993, pg. 168-175) Principles:	**Honebein (1996, pg.11-12) Pedagogical Goals:**	**Brooks and Brooks (1999, pg. 85-100) Principles:**	**Fosnot and Perry (2005, pg. 33-34) Principles:**
All Knowledge is Constructed	To provide experience with the knowledge construction process	Posing problems of emerging relevance to learners	Learning is not the result of development; learning is development
Multiple Perspectives	To provide experience in and appreciation for multiple perspectives	Structuring learning around 'big ideas' or primary concepts	Disequilibrium facilitates learning. Challenging, open-ended investigations in realistic, meaningful contexts
Knowledge is Effective Action	To embed learning in realistic and relevant contexts	Seeking and valuing students' points of view	Reflective Abstraction is the driving force of learning. Allowing reflection time.
Human Learning is Embedded Within Social Coupling	To encourage ownership and a voice in the learning process	Adapting curriculum to address students' suppositions	Dialogue with a community engenders further thinking
Knowing is not Sign Dependent	To embed learning in social experience	Assessing student learning in the context of the teaching	
World Views Can Be Explored and Changed with Tools	To encourage the use of multiple modes of representation		
Knowing How We Know is the Ultimate Human accomplishment	To encourage awareness of the knowledge construction process		

Table 2.5 Principles and Pedagogical goals of Constructivism

Therefore, instruction should be designed such that it supports the learners' in actively constructing their own understanding and knowledge (Duffy and Cunningham 1996, pg. 2). Moreover, these principles and pedagogical goals of constructivism specify certain teaching behavior which are cognizant of the learners' preference in this environment. Brooks and Brooks (1999) defined twelve descriptors of constructivist teaching behavior that makes for good guidance on the roles teachers should play in the constructivist learning environment.

These include among others, encouraging initiative and autonomy, use of interactive learning materials, use student responses to adapt the teaching and content, allow students to share their understanding of concepts, encourage a collaborative learning space and encouraging student enquiry.

There are several studies that underscore the importance of understanding the learning style and preferences of student in designing learning environments (Tsai et al 2012; Lai et al 2016). Given that mobile learning is well aligned to the principles and concepts of constructivism as described above, its attributes and implications for teaching and learning must be considered (Chuang and Tsai 2005; Chu and Tsai 2005; Tsai 2008; Tsai et al 2012; Lai et 2016).

Generally, this view is supported by Tsai et al (2012, pg. 251) who stressed the significance of understanding "the relationship between students' preferences and the features of learning environments" since it will have implications for instructional design. Several studies have utilized the principles and pedagogical features of constructivism to develop scales for measuring students' preferences towards these environments.

For instance, Chuang and Tsai (2005) developed the Constructivist Internet-based Learning Environment Survey (CILES) which consisted of six scales; student negotiation, inquiry learning, reflective thinking, relevance, ease of use and challenge (as seen in Table 2.6 below). These scales allowed for the exploration of student preferences for internet based learning environments.

Chuang and Tsai (2005) CILES	Tsai (2008) CILES-R	Tsai et al (2012) CULES	Lai et al (2016) MLEPS
Student Negotiation	Student Negotiation	Student Negotiation	Student Negotiation
Inquiry Learning	Inquiry Learning	Inquiry Learning	Inquiry Learning
Reflective Thinking	Reflective Thinking		
Relevance	Relevance	Relevance	Relevance
Ease of Use	Ease of Use	Ease of Use	Ease of Use
Challenge	Challenge		
	Multiple Sources	Multiple Sources	Multiple Sources
	Cognitive Apprenticeship		
	Epistemological Awareness		
		Adaptive Content	Adaptive Content
		Timely Guidance	Timely Guidance
		Continuity	Continuity

Table 2.6 Summary of Scales Used for Learners Preferences in Constructivist Based Learning Environment

Later, Tsai (2008) opined that there are three key features of an Internet-based learning environment that the original CILES did not take into consideration. He therefore modified the CILES to CILES-R to include the scales of multiple sources and interpretations, cognitive apprenticeship and epistemological awareness, see Table 2.7 below for description of the scales (Tsai 2008, pg. 19).

In yet a further research, Tsai and his colleagues developed a scale for learning preferences where "students can access digital materials or feedback through mobile devices in real situations" (Tsai et al 2012, pg. 251), that is a Context-aware Ubiquitous-Learning Environment Survey (CULES).

Aspect	Description	Factor(s) or scale(s) included
Technical	Assessing the technical usage in the Internet-based learning environments	• Ease of use[a]
Content	Exploring the features of the information contained in the Internet-based learning environments	• Relevance[a] • Multiple sources and interpretations[b] • Challenge[a]
Cognitive	Investigating the cognitive activities or strategies involved in the Internet-based learning environments	• Student negotiation[a] • Cognitive apprenticeship[b] • Inquiry learning[a]
Metacognitive	Assessing the possibility of promoting metacognitive thinking by the Internet-based learning environments	• Reflective thinking[a]
Epistemological	Examining the opportunities of exploring the nature of knowledge as provided by the Internet-based learning environments	• Epistemological awareness[b]

[a] Original scale in CILES.
[b] New scale in this study (CILES-R).

Table 2.7 Description of Scale used for CILES and CILES-R
Source: Tsai (2008, pg. 20)

They utilized relevant scales from the CILES and CILES-R and added two new scales, namely continuity and adaptive content (see Table 2.8 below). A later study by Lai et al (2016) developed the Mobile Learning environmental preferences survey (MLEPS) using the scales developed by Tsai et al (2012).

Aspect	Description	Scale
Technical	Measuring the technical usage in the u-learning environments.	Ease of use[1] Continuity[2]
Content	Investigating the features of the information included in the u-learning environments.	Relevance[3] Adaptive content[2] Multiple sources[3]
Cognitive	Exploring the cognitive activities and social interactions involved in the u-learning environments.	Timely guidance[1] Student negotiation[3] Inquiry learning[3]

[1]Revised CILES and CILES-R scale.
[2]New scale in this study (CULES).
[3]Original scale in CILES and CILES-R

Table 2.8 Description of Scale used for CULES
Source: Tsai et al (2012, pg. 253)

These constructivist learning preference scales have been validated and found to meet internal consistency criteria (α > 0.7) as well as a good level of variance (>= 64%) have been accounted for by the scales (see Table 2.9 below for comparative analysis).

Scale Criteria	**Chuang and Tsai (2005) CILES**	**Tsai (2008) CILES-R**	**Tsai et al (2012) CULES**	**Lai et al (2016) MLEPS**
Overall Cronbach Alpha Coefficient	0.97	0.94	0.97	0.96
Total Variance Explained	74.92%	64%	79.33%	82.26%

Table 2.9 Comparison of Constructivist Learning Preference Scale Suitability

Therefore, for this research to operationalize objective 3, that is, to explore the mobile learning preferences of adult learners based on the constructivist learning**,** the various scales derived from the above review were utilized.

2.5 Chapter Summary

The above review has critically examined the key academic literature, underlying theories and frameworks relevant to mobile learning and included the implications of these theories for practice. It is clear from the review that several issues arise when trying to devise a mobile pedagogy. Albeit, the review found that the traditional theories of learning are still relevant today, as their concepts and notions can be delivered and designed using mobile technology. This view is supported by Laurillard (2009, pg. 5) who stated “it is possible to use the education theories already developed about what it takes to learn” to exploit mobile technology.

Firstly, the review to this point focused on the evolution of pedagogy in higher education, which revealed that learning required a dialectical relationship between teachers and students without dichotomizing the reflection of reality thus establishing an authentic dialogue. Essentially, requiring a move away from the beginnings of pedagogy as the science of teaching, that is, teacher centered to a now truly student centered environment, where the focus is not on teaching but rather on learning, thus reflecting a new epistemological stance in education. Therefore, practitioners must not be caught up in just reproducing practice but to recognize the potential of digital technology to make learning innovative and also recognize the implications from the theories of learning in shaping the teaching strategies.

In addition, existing pedagogical frameworks may not provide adequate basis for learning using mobile technology as argued by Ozdamli (2012). In addition, Taylor et al (2006) argued that no single current theory of learning satisfies the mobile learning environment. Furthermore, Traxler (2010, pg. 63) contends that existing frameworks for formal education are not compatible with mobile learning. Moreover, conventional theories of learning have made the assumption that learning is situated in a formal learning space and therefore “fail to capture the distinctiveness of mobile learning” (Taylor et al 2006, pg. 142).

Further to this, the literature shows that uniqueness of mobile learning must be accounted for in the development of a mobile learning framework. These unique requirements largely point towards constructivism theory as being a solid platform for theorizing further on the use of mobile technology for both formal and informal learning. It is for this reason that constructivism was used as the basis for the investigation of the learning preferences of learners in private higher education institutions towards a mobile learning environment.

In closing this chapter, the development of any framework for mobile learning adoption requires an understanding of the affordance that mobile technology can contribute to the learning process before implementation into practice at higher education institutions. In addition, this understanding must be within the context of understanding the attitudes, behavioural intention and motivation for mobile learning adoption of adult learners.

Since, according to Sharples et al (2005) implementation of educational technology into the learning process should include the learner, the teacher and the technology. As such, the design of any new learning environment using mobile technology must incorporate the attitudes of learners towards mobile learning. This view is supported under the social-constructivist theory of learning, in particular activity theory, where "the shifting and developing object of an activity is related to a motive which drive it. Individual (or group) action is driven by a conscious goal." (Daniels 2001, pg. 86). Moreover, as purported by Malone and Lepper (1987 as cited by Ciampa 2013, pg. 82) "motivation is a necessary precondition for student involvement in any type of learning activity".

This focus on learner attitude and behaviour provided the impetus for the research and the basis for the succeeding chapter, where a critical examination of the underlying theory of technology adoption and user motivation will be undertaken. This view is supported by Thongsri et al (2018, pg. 280) who stated "in changing the learning style from traditional learning to technology-driven learning, it is necessary to study the motivation of students along with the adoption of the technology". Therefore, the next chapter will provide insights into the underlying theory relative to objective 1 and 2 of the research.

CHAPTER 3 MOBILE LEARNING ADOPTION THEORY

3.0 Introduction

Mobile technology can offer a great opportunity to develop innovative and new ways of enhancing the teaching and learning processes in higher education for learners. However, as elucidated by Kumar and Chand (2019, pg. 471) "integrating mobile technology in teaching and learning process is a challenging task" and is therefore not automatic. Whilst there are many research papers on mobile learning adoption, there is a shortage of examples that have thoroughly capitalized on the affordance of mobile technology (Kumar and Chand 2019). Therefore, it is the researcher's view that a careful study of the learners' acceptance of using mobile technology for learning is imperative to provide a strong basis for designing a mobile learning environment. Similarly, Chavoshi and Hamidi (2018, pg. 136) holds the view that "acceptance of a new system or technology is the first step in its successful implementation". Furthermore, Khanh and Gim (2014, pg. 51) suggest that the benefits to be derived from mobile learning "depend on the intention of students to use them for educational purposes". This chapter will therefore provide the theoretical underpinning for the achievement of the research objectives 1 and 2, that is, to evaluate the motivational factors that influence behavioural intention of adult learners to use mobile learning and to evaluate the pedagogical factors that influence behavioural intention of adult learners to use mobile learning. In other words, the factors that were used to investigate mobile learning adoption was derived from the underlying theories discussed herein.

There are various models which have been used to study adoption to new technology in various fields including education (Legris at al 2003, Hsia 2016). With regards to student's adoption of mobile learning, Karimi (2016) suggest that the Technology Acceptance Model (TAM) and the

Unified Theory of Acceptance and Use Technology (UTAUT) are accepted theoretical frameworks. For instance, TAM was used as the basis for mobile learning adoption studies conducted by Liu et al (2010), Park et al (2012), Khanh and Gim (2014), Joo et al (2016), Hsia (2016), Briz-Ponce et al. (2017) and Hao et al (2017). Whereas, the UTAUT has been used by Wang et al (2009), Abu-Al-Aish and Love (2013), Karimi (2016) and Arain et al (2019).

Therefore, with the view of providing a sound theoretical foundation for the research, the subsequent sections of this chapter will focus on a review of TAM. More specifically, the review will scrutinize the evolution of TAM in response to criticisms levelled against it, such as its lack of consideration for the motivational factors that predict adoption and intention to use. Consequently, the review will delve into Uses Gratification Theory (UGT), which provided the basis for extending the TAM for this research.

3.1 Technology Acceptance Model (TAM)

The TAM was initially developed to explain the central causes of user acceptance towards information technology (Davis 1989), which was premised on the Theory of Reasoned Action (TRA) postulated by Fishbein and Ajzen (1975). According to Ajzen and Fishbein (1980, p. 4 as cited by Davis et al 1989, pg. 983) TRA was "designed to explain virtually any human behaviour". In other words, as outlined by Liu et (2010) and Khanh and Gim (2014) TRA proposes that belief affect attitude, which is the stimulus for intention and intentions result in actual use behaviours as seen in Figure 3.1 below.

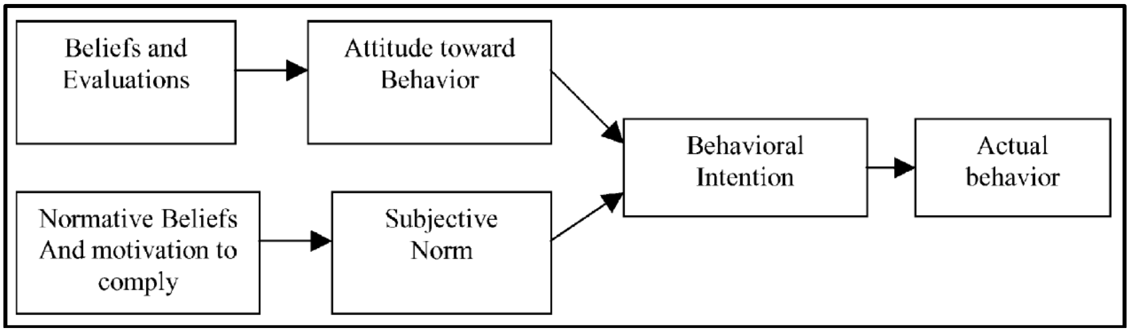

Figure 3.1 Theory of Reasoned Action Fishbein and Ajzen (1975)
Source: Legris et al (2003, pg. 192)

Using TRA as a foundation, Davis (1989) proposes two concrete constructs in the TAM that forms the main determinants of users' acceptance of new information technology, namely, Perceived Usefulness (PU) and Perceived Ease of Use (PEoU). Davis et al (1989, pg. 983) theorizes that the TAM specifies "the causal linkages between two key beliefs: perceived usefulness and perceived ease of use, and users' attitudes, intentions and actual computer adoption behaviour". In addition, Davis et al (1989, pg. 984) postulated that TAM provides the basis for "tracing the impact of external factors on internal beliefs, attitudes, and intentions".

Essentially, this belief, attitude, intention behaviour of the TAM sheds light on several propositions as seen in Figure 3.2 below. Firstly, Usage is determined by Behavioural Intentions (BI), where BI is determined by both the users' Attitude towards using the system (A) and Perceived Usefulness (PU), and where Attitude (A) is determined by the two main constructs of PU and PEoU (Davis et al 1989, pg. 985). So in effect, PU and PEoU both have implications for determining the users' behavioural intention to use technology (Venkatesh 2000). In fact, according to Davis et al (1989, pg. 987) "TAM posits that PU has a direct effect on BI over and above A". This is the case as users will form intentions towards use "based largely on a cognitive appraisal of how it will improve their performance" regardless of the positive or negative feelings of the behaviour (Davis et al 1989, pg. 986).

Secondly, the model suggests that the effect of external variables such as self-efficacy, on Behavioural Intentions (BI) is mediated by PU and PEoU and that all things being equal, PEoU will influence PU since the easier the technology is to use the more useful it can be (Venkatesh 2000).

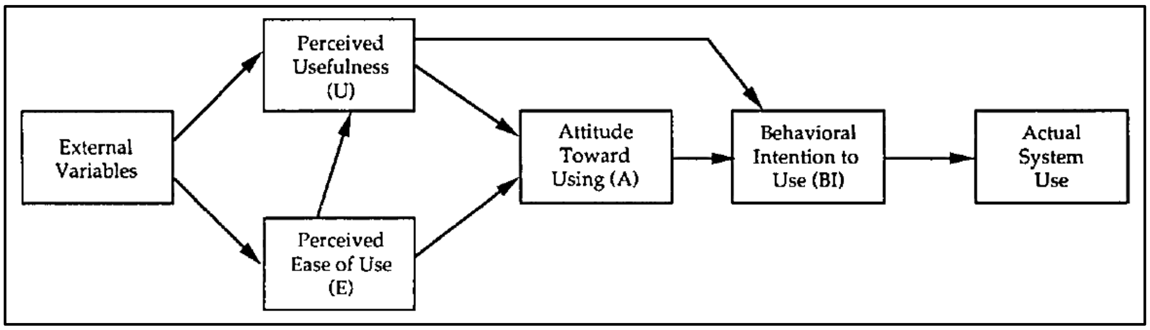

Figure 3.2 First Modified TAM Model
Source: Davis et al (1989, pg. 985)

Further analysis reveals that whilst Attitude towards using the system should mediate behavioural intention, which is consistent with TRA, subsequent research have shown that this is not the case. Since, as stated by Davis and Venkatesh (1996, pg. 20) the "effect of perceived usefulness on intention is only partially mediated by attitude". In addition, this view is consistent with the findings from Davis et al (1989, pg. 994) who posit that Perceived Ease of Use (PEoU) has a direct effect on BI, also the effect is fully indirect through Perceived Usefulness (PU). In other words, "the A-BI link becomes nonsignificant" Davis et al (1989, pg. 994). As such, the final TAM model (see Figure 3.3 below) excluded the Attitude construct, which according to Venkatesh (2000, pg. 343) "helps better understand the influence of perceived ease of use and perceived usefulness on the key dependent variable of interest-intention".

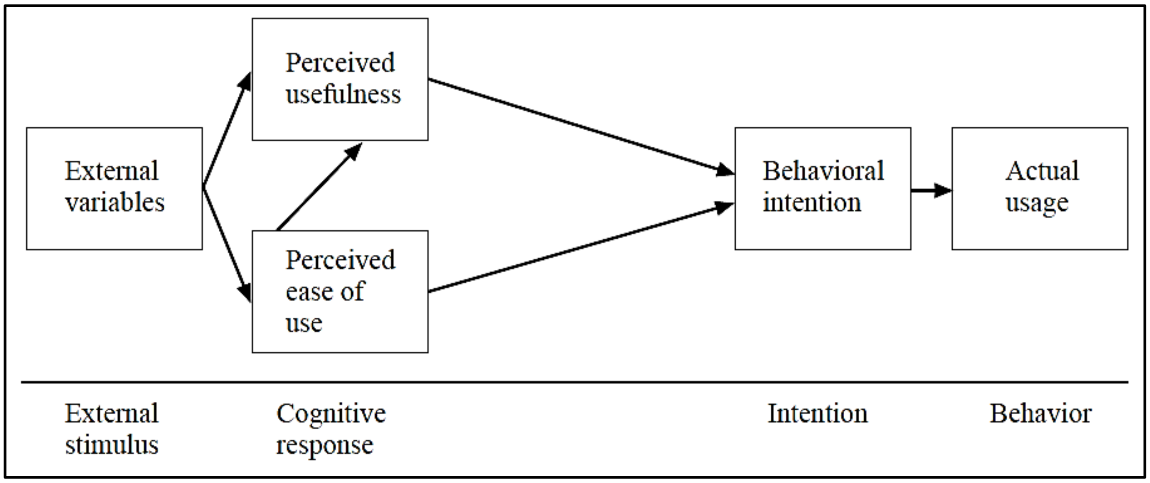

Figure 3.3 Final TAM
Source: Davis and Venkatesh (1996, pg.20)

This particular TAM Model does not include Subjective Norms (SN) originally derived from TRA (Legris et al (2003, pg.192), as its effect on Behavioural Intention was insignificant due to the "uncertain theoretical and psychometric status of SN" (Davis et al 1989, pg.986). However, in the face of criticism that very little research was done to understand the antecedents of perceived ease of use, which led to a lack of information for meaningfully designing systems. Venkatesh and Davis (1996, pg. 473) conceded that "in order to be able to explain user acceptance and use, it is important to understand the antecedents of the key TAM constructs, perceived ease of use and usefulness". Therefore, through further research, Venkatesh and Davis (1996, pg.465-466) postulated that an individual's ease of use perception after hands on experience of using the system can be explained by their self-efficacy and usability, which accounted for 57% of the variance.

Furthermore, Venkatesh (2000) argued that users will form ease of use perceptions based on their general belief of computer use. As a result, Venkatesh (2000, pg. 346) proposed "constructs related to control, intrinsic motivation and emotion" as anchors for ease of use perception. In relation to control, it constitutes an internal anchor, that is, self-efficacy and an external anchor, that is, facilitating conditions. Additionally, intrinsic motivation is hypothesized as playfulness and emotion purported as anxiety. Venkatesh (2000, pg. 357) found that these "determinants explained up to 60% of the variance in perceived ease of use". Moreover, Venkatesh (2000) found that with increasing hands on experience of using the system, perceived ease of use was stronger. Interestingly, self-efficacy and facilitating conditions effects were consistently strong under this adjustment, however, playfulness and anxiety effects on ease of use perception were reduced.

Subsequently, Venkatesh and Davis (2000, pg.187) stated that "the determinants of perceived usefulness have been relatively overlooked" and therefore, sought to extend the Technology Acceptance Model (TAM) to include the determinants of perceived usefulness since it provides a strong explanation of usage intentions. As such, TAM2 sought to include the antecedents of perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes (Venkatesh and Davis 2000) as seen in Figure 3.4 below. Given the nature, purpose and scope the research, it is imperative that a greater understanding of the later is proffered.

Social influence processes consisted of three interrelated social forces, which were based on "Kelman's (1958, 1961) work on social influence and French and Raven's (1959) work on power influences" (Venkatesh and Bala 2008, pg. 277). Specifically, the social influence mechanism of compliance, identification and internalization were used to understand and define the three social influence processes. According to Venkatesh and Davis (2000, pg. 187) these social influence processes include subjective norms, image and voluntariness.

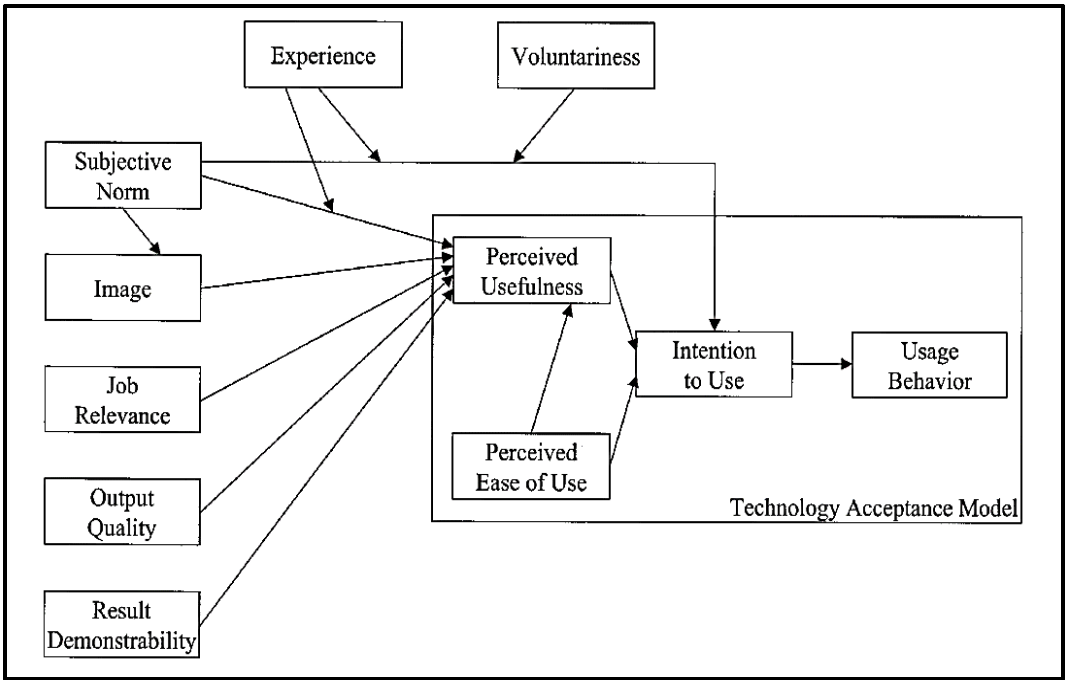

Figure 3.4 TAM 2- Extension of TAM
Source: Venkatesh and Davis (2000, pg. 188)

Voluntariness was included as a moderator between subjective norm and behavioural intention. The reason cited for this moderating effect of voluntariness can be explained by the underlying social force of compliance (Venkatesh and Davis 2000, pg. 188). Furthermore, based on compliance, as in TRA, TAM 2 theorized subjective norm as a direct determinant of behavioural intention. Their findings revealed that the compliance effect explained the rationale for subjective norm directly accounting for more variance than perceived usefulness and ease of use on behavioural intention in a mandatory context but not in a voluntary situation (Venkatesh and Davis 2000, pg. 198). In addition, Venkatesh and Davis postulated that “subjective norm can influence intention indirectly through perceived usefulness” (Venkatesh and Davis 2000, pg. 189), this was predicated and supported by the concepts of internalization and identification (Venkatesh and Bala 2008).

In yet a further study, Venkatesh and Bala (2008) extended TAM 2 by integrating the earlier works of Venkatesh (2000) on the determinants of perceived ease of use. Thus, according to Venkatesh and Bala (2008, pg. 279) "TAM3 presents a complete nomological network of the determinants of individuals' IT adoption and use".

TAM 3 focused on the moderating effect of experience on three key relationships that were not tested in previous studies of TAM 2 (Venkatesh and Davis 2000) and determinants of perceived ease of use (Venkatesh 2000). Essentially, three new relationships were postulated in TAM 3 (Venkatesh and Bala 2008):

1. Perceived ease of use to perceived usefulness, moderated by experience
2. Computer anxiety to perceived ease of use, moderated by experience
3. Perceived ease of use to behavioural intention, moderated by experience

The results from their longitudinal study using four organizations revealed that "TAM3 was able to explain between 52% and 67% of the variance in perceived usefulness across different time periods" (Venkatesh and Bala 2008, pg. 286). Furthermore, there were no significant effects of the determinants of ease of use on perceived usefulness. However, the results supported the notion that experience moderated the effect of ease of use on perceived usefulness. In fact, it was found that with growing experience the effect become stronger (Venkatesh and Bala 2008, pg. 286).

With regards to perceived ease of use, TAM 3 explained between 43% and 52% of variance. In addition, the relationship between computer anxiety and perceived ease of use was found to be moderated by experience to extent that the effect became weaker with increasing experience (Venkatesh and Bala 2008, pg. 290).

Lastly, the study concluded “that experience, in fact, moderated the effect of perceived ease of use on behavioural intention such that with increasing experience the effect became weaker” (Venkatesh and Bala 2008, pg. 290).

3.1.1 Justification for using TAM

So, what is the relevance and implication of technology adoption models for mobile learning adoption? What have previous studies found? And is TAM an appropriate model for evaluating intention of students to adopt mobile learning? This section will address these issues so as justify the use of TAM as a key anchor for this research with respect to shedding light on the antecedents of mobile learning adoption.

There have been several studies on mobile learning adoption in past decade, in fact Kumar and Chand (2019) in their systematic review found that forty-two percent (42%) of the research into mobile learning adoption were based on the use of TAM and a further twenty-three percent (23%) were based on UTAUT. Furthermore, the majority of research focused on perceived ease of use and perceived usefulness as the key constructs for determining intention to adopt mobile learning (Kumar and Chand 2019).

Park et al’s research into factors affecting Korean university students’ adoption and intention to use mobile learning involved two hundred and eighty-eight (288) students in the analysis (Park et al 2012). The study revealed mixed results with respect to the direct effect on behavioural intention (BI). For instance, it was concluded that attitude (A), subjective norm (SN) and system accessibility (SA) were significant for BI, with attitude being the strongest predictor of BI with β = 0.35 as seen in Figure 3.5 below. However, neither perceived usefulness (PU) or perceived ease of use (PEoU) had a significant direct effect on BI.

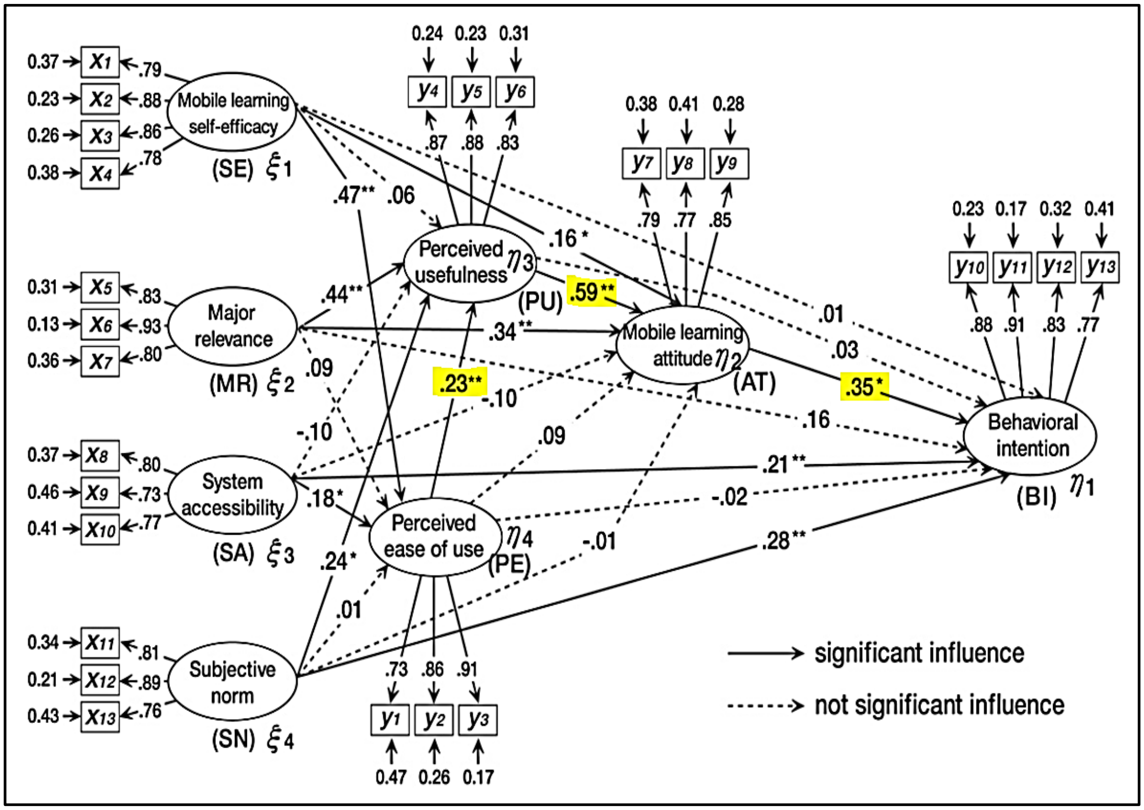

Figure 3.5 Park et al's Research Results
Source: Park et al (2012, pg. 601)

But, when considering the indirect effect, PU on BI was found to be 0.207 (Park et al 2012, pg. 602). This coupled with the findings that PEoU directly affected PU (β = 0.23) and PU was found to be the largest determinant to attitude (A) (β = 0.59), PU and PEoU were considered good predictors of intention to use mobile learning and therefore "the original TAM was good enough to explain university student's m-learning acceptance" Park et al (2012, pg. 601).

Similarly, research conducted by Khanh and Gim (2014) with three hundred and one (301) students from five (5) Universities in Vietnam found that the TAM factors were significant determinants of mobile learning acceptance. However, contrary to Park et al (2012), perceived usefulness was found to be the most significant direct effect on BI (β = 0.48) see Figure 3.6 below (Khanh and Gim 2014, pg. 58).

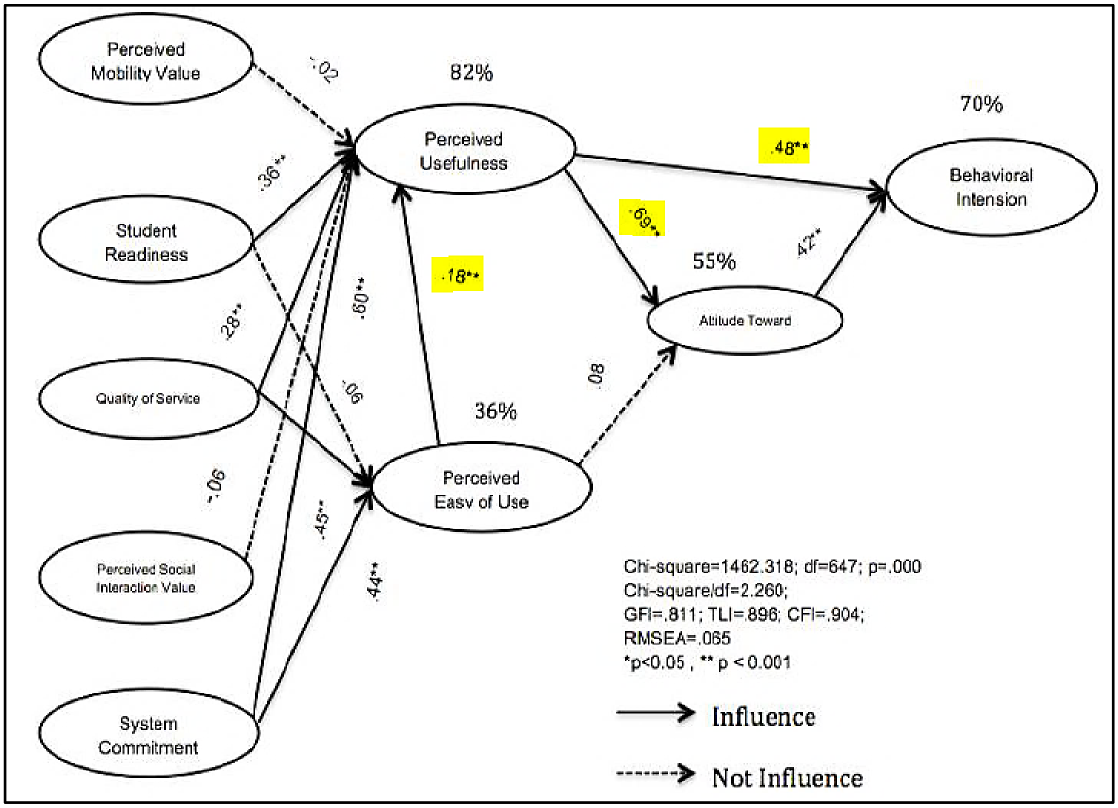

Figure 3.6 Khanh and Gim's Research Result
Source: Khanh and Gim (2014, pg. 59)

Furthermore, as seen in the research results above, PU proved to be the strongest predictor of attitude (A) with β = 0.69, whereas, PEoU was found to be an insignificant predictor of A, this is consistent with Park et al (2012) but in contradiction to Li et al (2008) and Legris et al (2003) as cited by Khanh and Gim (2014, pg. 59).

In addition, there is consistency in the findings regarding PEoU effect on BI in both Park et al (2012) and Khanh and Gim (2014), that is, PEoU has no direct effect on BI, which is consistent with the TAM's proposition. This view was confirmed by Joo et al (2016) whose findings from two hundred and twenty-two (222) university students, concluded that there was no direct relationship between PEoU and BI.

Conversely, in a study involving one hundred and eighty-three (183) students by Hsia (2016), PEoU was found to be a significant determinant of BI with β = 0.20, see Figure 3.7 below.

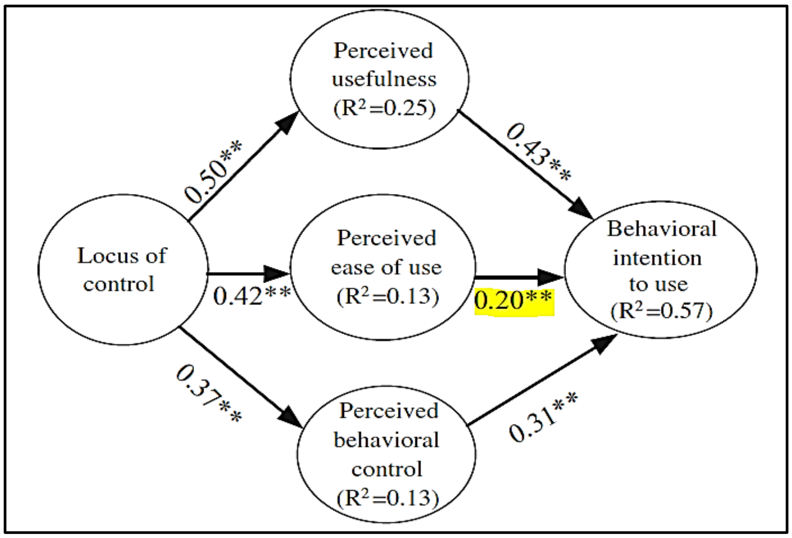

Figure 3.7 Hsia's Research Result
Source: Hsia (2016, pg. 11)

Furthermore, findings from Hao et al (2017) study with two hundred and ninety-two (292) students confirmed the TAM Model, but more interestingly and similarly to Hsia (2016), also found a significant effect between PEoU and BI as seen in Figure 3.8 below.

Moreover, Chavoshi and Hamidi (2018) results from Iranian University students also established a positive effect of PEoU on BI confirming the earlier findings of Hao et al (2017), Hsia (2015) as discussed above.

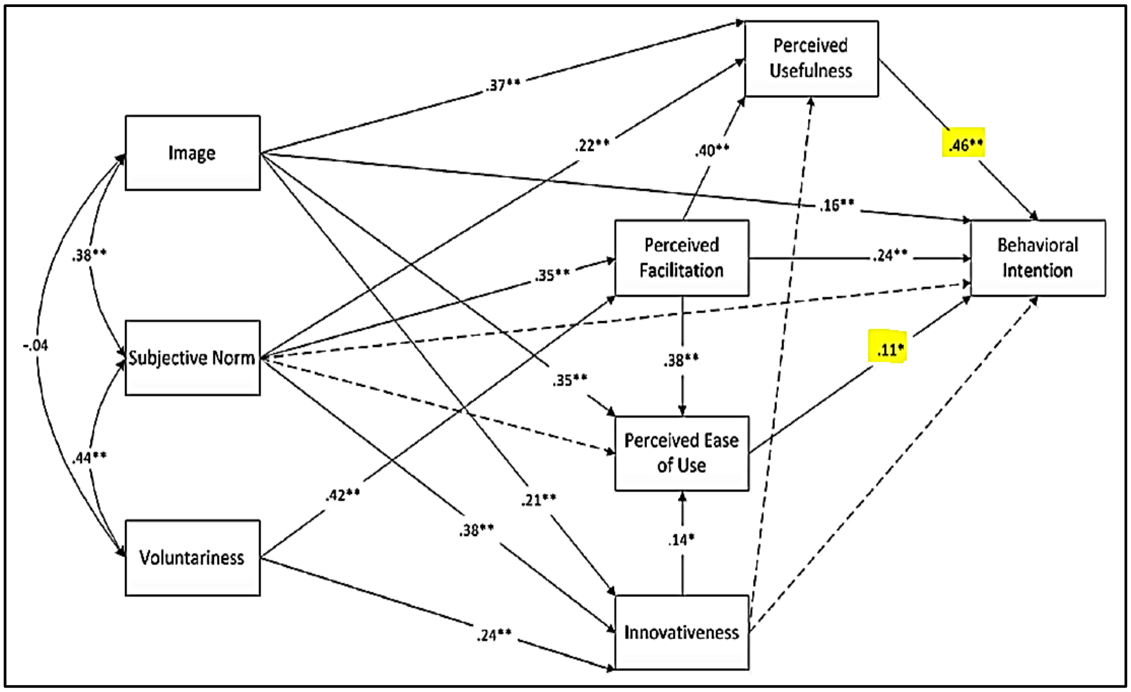

Figure 3.8 Hao et al's Research Result
Source: Hao et al (2017, pg. 109)

From the review above there are three (3) emerging themes (see Table 3.1 below). Firstly, there is consensus on the direct relationship between perceived usefulness (PU) and behavioural intention (BI). Secondly, there is a significant link between PEoU and PU. These relationships are supported by TAM. However, the third theme that emerged from the review of the research conducted on mobile learning adoption revealed a relationship between PEoU and BI, this is not supported by the original TAM. However, it can be reasonably supported, since the implications suggests that students will not only find the mobile learning environment useful to their learning because it is easy to use. Moreover, the ease of use itself will have direct implications for intention to adopt since the mobile learning applications will not be complicated and frustrating to use.

Authors	PU→BI	PEoU→PU	PEoU→BI
Park et al (2012)	0.207* (indirect)	0.23*	-0.2
Khanh and Gim (2014)	0.48*	0.18*	
Hsia (2015)	0.43*		0.20*
Joo et al (2016)	0.70*	0.47*	-0.19
Hao et al (2017)	0.46*		0.11*
Chavoshi and Hamidi (2018)	0.508*	0.383*	0.221*
* Significant			

Table 3.1 Summary of Previous Research on Mobile Learning Adoption

These findings confirm the relevance of TAM as a good fit for explaining adoption of mobile learning by higher education students. In general, TAM has been consistently found to be a robust framework for researching acceptance of a wide variety of technology innovations (Liu et al 2010). This view has also been confirmed more recently by Salahshour Rad et al (2018, pg. 364), who reviewed 330 journal articles published between 2006 and 2015, by asserting that "TAM's popularity can be ascribed to its simplicity in terms of theoretical attributes, empirical foundation, and general applicability in both existing and new technology adoption issues in diverse domains." Moreover, as expounded by Venkatesh (2000, pg. 344) TAM parsimonious nature facilitates its application in different situations and context, including the acceptance of educational technologies in the context of higher education (Huang et al 2007, Liu et al 2010, Park et al 2012, Hsia 2015, Hao et al 2017).

In addition to its applicability to the educational context, Davis and Venkatesh (1996, pg. 21) stated that "the Cronbach alpha reliability of the TAM scales have generally been found to exceed 0.9 across numerous studies" further validating its robustness and transferability to other contexts. From the studies on mobile learning adoption reviewed above, the Cronbach alpha values (see Table 3.2 below) were well above the acceptable threshold of 0.7 as suggested by Hair et al (2010).

Authors	Range of Cronbach Alpha value for Scales	Behavioural Intention, R^2
Khanh and Gim (2014)	0.77-0.93	0.70
Hsia (2015)	0.78-0.90	0.57
Hao et al (2017)	0.78-0.92	0.60
Chavoshi and Hamidi (2018)	0.73-0.89	0.44

Table 3.2 Reliability and Variance from Previous Research on M Learning Adoption

Furthermore, in all cases in Table 3.2 above, the TAM constructs were able to explain more than 44% of the variance of Behavioural Intention (BI). This is consistent with findings from Vankatesh and Davis (2000, pg. 186) who pontificated that "numerous empirical studies have found that TAM consistently explains a substantial proportion of the variance (typically about 40%) in usage intentions and behaviour". Moreover, Cohen (1987) as cited by Chavoshi and Hamidi (2018) suggests that when the proportion of variance explained (R^2) is greater than 0.35, it represent a substantial model. Interestingly, Legris et al (2003, pg. 202) suggested that because TAM could "hardly explain more than 40% of the variance in use" that in itself was a key limitation of the TAM. Consequently, notwithstanding the above reasons justifying the validity of using TAM as an explanation for mobile learning adoption, it is not without critiques.

One such criticism levelled against TAM by Legris et al (2003, pg. 202) is that the model measures the variance in self-reported use not actual use and therefore is not a precise measure. Additionally, Legris et al (2003) goes further to indicate that TAM assumes technology adoption to be independent of the larger organizational context. Put in the context of mobile learning, using TAM as the sole theoretical underpinning would mean not taking into account the pedagogical and motivational factors, which both play a pivotal role in adoption of technology driven learning. In line with this, Legris et al (2003) opined that in order to improve the predictive capacity of TAM it should be integrated with other models that accounts for the organizational and social factors.

The review of the literature on previous research into mobile learning adoption by Kumar and Chand (2019) confirms this, as 69% of the papers that were based on formal technology adoption models were extended by adding additional factors in an attempt to create a suitable model. For instance, Hao et al (2017) extended the TAM model by integrating the new constructs: Image, voluntariness, perceived facilitation and personal innovativeness. Additionally, Briz-Ponce et al. (2017) analysed the mobile learning acceptance framework by integrating new constructs, namely social influence, attitude toward using technology, reliability and recommendation, anxiety, facilitating conditions and self-efficacy with the TAM model.

In light of these criticisms and evidence that previous researchers have indeed found it necessary to extend, modify and integrate the TAM with other models or constructs. This suggests that TAM single-handedly cannot provide the theoretical support for this research.

To this end, the main constructs from TAM are adopted for this research as it provides the foundation to understanding learners' intention to adoption mobile learning. The chosen TAM constructs are then augmented by including constructs representing motivation of learners, since the general outcome of the research involves moving from a traditional learning environment to a constructivist mobile learning model. Therefore, this research extended TAM by integrating the Uses Gratification Theory (UGT) and the students' preference for constructivist learning as a predictor of behavioural intention. This will allow for the development of a more comprehensive research model that is more appropriate for studying mobile learning acceptance by university learners.

Therefore, the subsequent sections of this chapter will elucidate on these important concepts to this research.

3.2 Uses Gratification Theory

In relation to education, the role of communication and moreover, the selection of media by students to support their learning process so as to satisfy their social and psychological needs, should not be underestimated (Mondi et al 2008) as it provides the means by which knowledge is transferred.

Uses Gratification Theory (UGT) is an influential and well known theoretical base for studying media use (Lin 1999), since according to Rubin (1984, cited in Joo and Sang 2013, pg. 2513) UGT "explores the questions about why and how people seek to use media to fulfil their needs and motives". Katz et al (1973, pg. 165) argues that the users "selection of media and content, and the uses to which they are put, are considerably influenced by social role and psychological predisposition".

The seminal study by Katz et al (1973) and the publication of Blumer and Katz's (1974) *The Uses of Mass Communication*, provided the underlying assumptions of UGT (Palmgreen 1984). Perhaps the most fundamental supposition is that "media users are goal directed in their behaviour" (Guo et al 2011, pg. 2184) that is, they are motivated by their aspiration to satisfy their needs (Joo and Sang 2013). More importantly, with users being aware of their varied range of needs, will "take the initiative in selecting and using communication vehicles to satisfy felt needs and desires" (Livaditi et al 2003, pg. 2).

In the context of mobile learning adoption, this means that students' will be motivated to use a mobile technology enhanced learning environment if and only if it will lead to gratification of their learning needs. This is supported by Rubin (2002 cited in Mondi et al 2008, pg. 242), who stated that "media cannot influence an individual unless that person has some use for that media or its messages". Furthermore, Stafford et al (2004, pg. 265) indicated that UGT presumes continued use of technology and innovations based on prior adoption and experience with the media. In other words, in the context of learning, students would continue to use a mobile learning environment once their initial use and adoption experience was gratifying, but will discontinue use if their experience was negative. This view is in line with Mondi et al (2003, pg. 242) who goes further to suggest that this behaviour by students "is in accord with the constructivism perspective of learning". This connection between student's behavioural intention towards media and constructivist learning style can be further explained by another key assumption of UGT.

That is, Livaditi et al (2003) postulated that the use of media is an active choice by users to satisfy their needs, which becomes necessary when there are competing sources of information. In the learning context, there are no shortages of media communicating and transferring information to the student. This gives rise to an active learner as opposed to a passive learner in a traditional teacher centered learning environment which does not present an opportunity for choice. It should be noted that UGT can only be relevant when students have a choice of media (Kuehn, 1994 cited by Guo et al 2011, pg. 2184).

Essentially, the availability of choice encourages the students to engage in an active process of intentionally choosing the right mix of educational media to satisfy their social and psychological learning needs and more importantly, "they are able to recognise their reasons for making media choices" (Mondi et al 2003, pg. 242).

Katz et al (1973, pg. 166) holds the view that there are five (5) meaningful classification of needs, that were derived from "literature on the social and psychological functions of the mass media". Therefore, in relation to mobile learning, students will seek to gratify the following needs through adoption and continued use (Katz et al 1973, pg. 166-167):

1. *"Needs related to strengthening information, knowledge, and understanding*
2. *Needs related to strengthening aesthetic, pleasurable and emotional experience*
3. *Needs related to strengthening credibility, confidence, stability, and status*
4. *Needs related to strengthening contact with family, friends, and the world*
5. *Needs related to escape or tension-release"*

Essentially, these have been simplified into cognitive, affective, social, personal integrative, social integrative and entertainment (Katz et al 1974 and Hamilton 1998, cited by Mondi et al 2008, pg. 243).

3.2.1 Justification for using UGT

It is important to note that unlike TAM, which considers social influence from a normative and extrinsic viewpoint, under UGT social influence are "operationalised in the form of individual motivations to engage in interpersonal interaction" (Stafford et al 2004, pg. 265). This means that students' individual motivations for adopting mobile learning can be explored through UGT. This overcomes a fundamental limitation of TAM and therefore forms the basis for integrating UGT with TAM for this research. In other words, instead of looking at students' social influence for adopting mobile learning from the stance of compliance and institutional goals, the researcher used the viewpoint that students should internalize the need to adopt based on their motivations to satisfy their learning needs.

However, as reported by Guo et al (2011, pg. 2184) UGT has been criticised because of its "heavy reliance on subjective reports of mental states, being too individualistic by providing little explanation on the formation of social and psychological needs". This view is circumvented by Mondi et al (2008) who opined that the underlying UGT concepts, which forms the basis of students' communication behaviour are indeed inseparable from the learning process. In other words, from a teaching and learning perspective, the students' choice of educational media initiates the learning process and that choice is based on their intention to satisfy their learning needs, whether it is cognitive, affective, social, personal integrative, social integrative or entertainment.

In further justifying the choice of UGT, its applicability must be assessed. As such, although UGT was originally applied to studies involving users' motivation for use of traditional media such as radio, television and telephone (Stafford et al 2004), according to Park (2010) and Hashim et al (2014) it can be applied to any media usage. This is evident as researchers have used UGT to study the internet as a media. For instance, Lin (1999) investigated the relations between perceived television use and online access motives, Stafford et al (2004) derived the dimensions of consumer internet usage as well as Park (2010) who examined the adoption of voice over Internet Protocol (VoIP). Several researchers have also adapted this theory to look at smartphone usage such as the work of Joo and Sang (2013). More importantly and in the context of this research, there is also evidence of UGT being applied to an educational context. For instance, Stafford (2005) applied UGT to examine internet usage motivations of distance learning students and Mondi et al (2008) investigated students' uses and gratification expectancy for e-learning. Also, Guo et al (2009) and Guo et al (2010) identified students' uses and gratifications for using technology enhanced communication in higher education.

Therefore, for this research UGT was unified with TAM to overcome the limitations of TAM creating a robust theoretical model for investigating mobile learning adoption in private higher education institutions in Trinidad. This view is supported by Park (2010), Joo and Sang (2013) and moreover by Hashim et al (2014).

More recently, Hashim et al (2014) and Thongsri et al (2018) have utilized UGT to determine the dimensions for mobile learning adoption in a higher education context. For instance, Hasim et al (2014, pg. 6) found that adult learners' intention to adopt mobile learning is significantly influenced by their social needs (β=0.324), cognitive needs (β=0.3016) and affective needs (β=0.136). Overall, their model was able to explain sixty-four (64%) of the variance for intention to adopt mobile learning ($R^2 = 0.637$). These results are similar to Thongsri et al (2018) whose model was able to explain sixty-three (63%) of the variance for intention to use mobile learning. Furthermore, the UGT factors of cognitive (β=0.136), affective (β=0.232) and social (β=0.324) needs all have a significant influence on intention to use mobile learning. Essentially, both studies have found that the motivational needs of students significantly affect and explain the intention to use mobile learning. Therefore, at this stage the research will now present the conceptual framework derived from the review of the literature conducted.

3.3 Conceptual Framework

In essence, this study integrated three main underlying theories, that is, TAM, UGT and constructivism theory of learning, in order to explore and evaluate the factors that explain the adoption of mobile learning. It is through these lens that an appropriate conceptual framework was derived. In other words, conceptual framework presented below (see Figure 3.9 below) reflects how the phenomenon of mobile learning adoption was explored and evaluated for this research. Furthermore, these factors of adoption will facilitate the augmentation of the current mode of teaching and learning in private higher education institutions through the use of mobile learning. In summary, these adoption factors were categorised into three areas; 1. Pedagogical factors drawn from TAM, 2. Motivational factors drawn from UGT and 3. Constructivist mobile learning preference.

In terms of the pedagogical factors, the literature review revealed that while the existing pedagogical approaches are to some extent still relevant to mobile learning, none more so than the constructivist pedagogy, there is still no clear mobile learning pedagogy. Therefore, this research used the constructivism theory of learning as the basis for exploring the students' mobile learning preference and its influence on mobile learning adoption. In addition, pedagogical factors were also drawn from the main constructs of TAM, that is, perceived usefulness, perceived ease of use and attitude (renamed learning relevance for this research).

With respect to the motivational factors; cognitive need, affective need, social need was drawn from UGT while self-Efficacy and subjective norm was drawn from TAM.

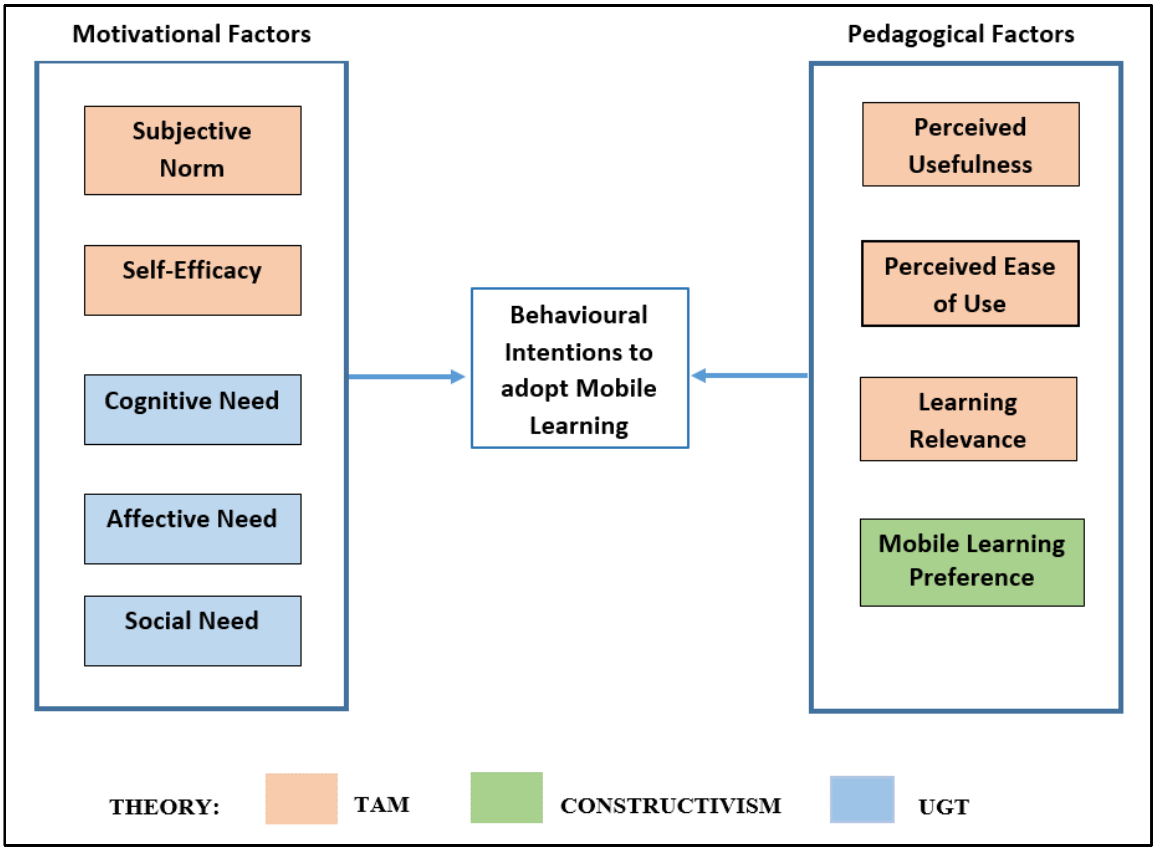

Figure 3.9 Conceptual Framework

Ultimately, the conceptual framework presented above clearly articulates the researcher's direction regarding the exploration of the pedagogical and motivational factors to explain the intention of students adopting mobile learning. Therefore, it was used as the basis for designing the research methodology discussed in the following chapter.

CHAPTER 4 RESEARCH DESIGN AND METHODOLOGY

4.0 Introduction

In this chapter, the researcher will provide an outline of the research design that was used to explore and investigate the research objectives, namely; the motivational and pedagogical mobile learning adoption factors, students' mobile learning preference for a constructivist environment and its influence on the students' intention to adopt mobile learning. Therefore, enabling the researcher to address the stated Research Question, **how can the adoption of Mobile Learning be used to augment the pedagogical strategies currently used for adult learners in the private higher education sector in Trinidad?**

Specifically, the research design herein is concerned with **What-** are the underlying assumptions of the researcher, **How-** the researcher conducted the research, that is, the data collection and analysis procedure and **Why-** this chosen plan was best suited for the study. As such, the framework postulated by Creswell (2009) was adopted to provide a basis for the structure of the research design. (See Figure 4.1 below).

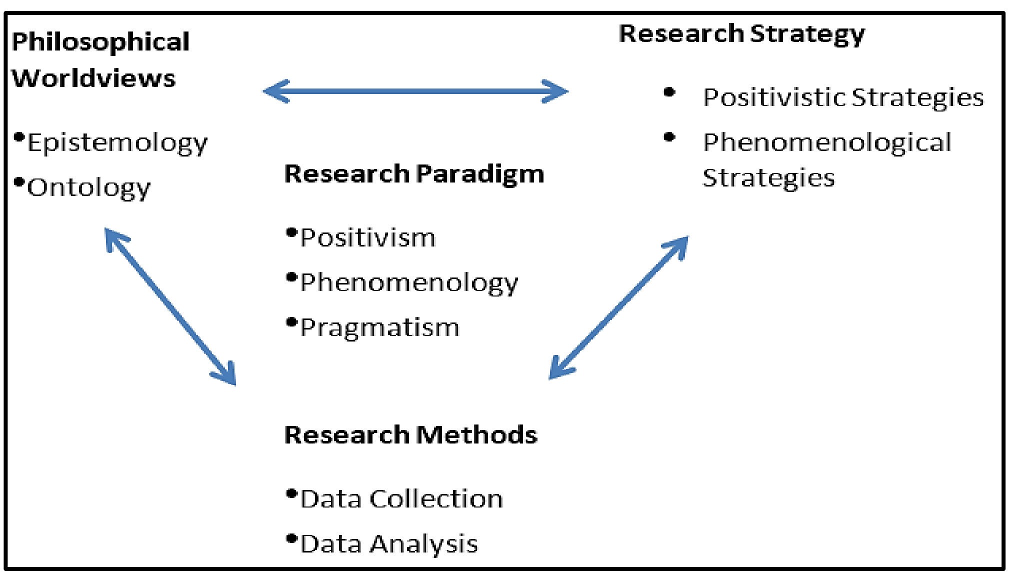

Figure 4.1 Framework of Research Design
Adapted from Creswell (2009)

Consequently, the succeeding sections of the chapter will provide a debate of the philosophical positions considered and used in the research and an analysis of action research methodology. In addition, the researcher would seek to operationalise the research by specifying the blueprint of HOW the research was conducted through the chosen data collection and data analysis procedure.

It must be noted, that throughout the development of the design the researcher was cognizant of the importance of reliability, validity and generalizability of the design as postulated by Bryman (2008). As such, these key yardsticks for a suitable and appropriate methodology are embedded within the following sections and will also be addressed directly where necessary.

4.1 Research Philosophy

It is possible to define the philosophy of social research as the study of the theories of knowledge which validate particular research practices. The philosophy of social research is a successor to the philosophy of science and was first used by John Hughes in 1980 as stated by Brewer (2003). Hughes (1980) outlined two models of social research, which were premised on two different theoretical positions, the natural science model based on positivism and the humanistic model based on naturalism.

Essentially, the philosophy of social science is primarily concerned with the issues of the researcher’s theoretical stance and the choice of ontological and epistemological assumptions as well as the justifications for their choices (Blaikie 2004). These assumptions about the nature of reality (ontology) and assumptions about the nature of knowledge (epistemology) are related to each other and can be amalgamated into a concept call a research paradigm (Burrell and Morgan 2017; Guba and Lincoln 1994).

Kuhn (1962) in his thesis, used the term paradigm to refer to exemplars of good science, key theories and most importantly, “the application of those theories in the solution of important problems” (Bird 2013). For Kuhn (1977) the key characteristic of a paradigm is that researchers needed to form a consensus on the theories that they developed which would permit agreement on the fundamentals of the solution to problems. However, in the field of social sciences researchers often have competing schools of thought, theories and assumptions. Therefore, Kuhn concluded “that there cannot be any paradigms in the social sciences, but that social sciences are in a pre-paradigmatic phase in the development of scientific knowledge” (Eriksson and Kovalainen 2008).

The implication of Kuhn’s work suggests that researchers who share the same set of beliefs and values can be classified as a paradigm. When taken from a research design perspective, Guba and Lincoln (1994) defined paradigm “as a world view or a belief system that guides a researcher in their work” and suggested that there were competing paradigms of inquiry.

The two main research paradigms that was under consideration for this study were positivism and interpretivism. But before any discourse is provided on these paradigms, it would be remiss of the researcher not to discuss the key concepts of ontology and epistemology which influenced the researcher’s choice of paradigm.

4.1.1 Ontology

Ontology is a philosophical discipline concerned with the nature of existence, "it relates to what is the essence of things that make up the world" (McLaughlin 2012) or simply stated, it is about the nature of reality. The key concern and consideration about the nature of reality and more importantly how reality is constructed should be "whether or not social reality exists independently of human conceptions and interpretations" (Snape and Spencer 2003). There are two ontological positions, namely, realism and idealism or often referred to as objectivism and subjectivism/constructivism.

Realism is defined by Phillips (1987, pg. 205) as the "view that exists independently of being perceived or independently of our theories about them". In addition, realism takes on the view that there is a single truth, a so called 'it is what it is and nothing else' as suggested by Schwandt (2007, pg. 258) "the view that real things are just exactly as science takes them to be".

This view on the nature of reality leads to objectivism, in which the phenomena and their meaning have an existence independent of our views or understanding about it. Therefore, the description of the phenomena is based on facts that existed to be revealed, which can be measured and analysed and is ultimately, independent of the social actor's sense of experience.

Conversely, idealism asserts that reality does not exist independently of our minds (Schwandt 2007, pg. 144). It is a philosophy that tries to say something about what lies behind or beyond experience, and in that sense, the German idealism of Fichte [1762–

1814], Schelling [1775–1854], Hegel [1770–1831], which is influenced by the philosophy of Kant's [1724–1804] transcendental idealism, provides a critical analysis of realism.

Kant, held that the only way we can conceive of ourselves as mind-endowed beings is in the context of existing in a world of space and time (Körner, 1955 cited in Williams 2004). For Kant, one of the key claims of transcendental idealism is that "Space and time are not things in themselves, or determinations of things in themselves that would remain if one abstracted from all subjective conditions of human intuition." (Rohlf 2014).

This view held by Kant suggests that there is no reality apart from what is in human mind and reality is a projection of the human mind which results in social constructivism. This means that the description of a phenomena is a social construction built up from the perceptions and actions of social actors. It involves a description based on their sense of experience which is "not only produced through social interaction but they are in a constant state of revision" (Bryman 2008, p.19). Additionally, Blaikie (1993, pg. 94) suggest that reality is about individuals and group interactions, therefore two realities alike cannot exist, resulting in no one truth, but indeed multiple realities of the phenomena.

Realism and idealism represent two extreme ontological positions (see Figure 4.2 below), however there are views which do not take either extreme. The work of Bhaskar (1979) critical realism and Hammersley (1992) subtle realism are valid variations of realism but influenced by idealism concepts of reality.

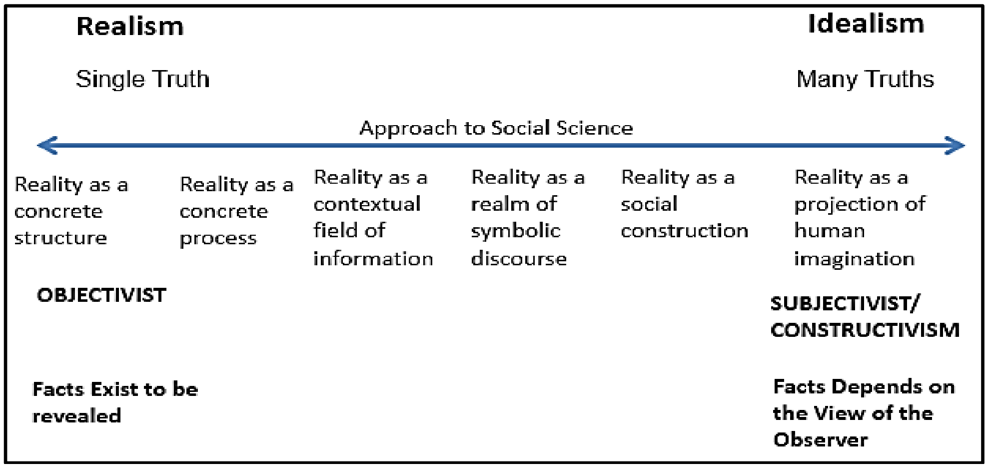

Figure 4.2 Continuum of Ontological Positions Adopted from Collis and Hussey (2009, pg.61)

4.1.2 Epistemology

Turning now to epistemology, which is concerned with nature of knowledge (Crotty 2003) and justification of the knowledge. It "explores how we know that we know something" (Baillie 2003, pg. 94) and how can credibility be assured. It thus attempts to answer the questions; What are the necessary and sufficient conditions of acceptable knowledge? And more importantly, is that justification internal or external to one's own mind? This question of whether knowledge is internal or external to social actors, has led to two opposing schools of thought. Firstly, **rationalism** and **empiricism** which are both based on the concept of **foundationalism** and secondly, **constructivism**, these two extremes are often referred to as objectivism and subjectivism respectively.

Rationalism asserts that knowledge can be derived through the logic of reasoning. It adopts an *a priori* stance to knowledge, which is to say knowledge is gained independently of sense experience. Key rationalists include Spinoza [1632-1677] and Leibniz [1646-1716] and Descartes [1596-1650], who defined knowledge in terms of doubt and defined doubt as the contrast to certainty. In other words, knowledge is justified when there is perfect certainty, an absence of doubt.

Empiricism on the other hand, asserts that our knowledge is *a posteriori*, dependent upon sense experience. Key empiricists include Locke [1632-1704], Berkeley [1685-1783] and Hume [1711-1776], have rejected the rationalist view of epistemology, citing that reason alone cannot provide superior knowledge, beyond what we can learn from experience.

Strict empiricism contends that knowledge is experiential and can only be justified by evidence of what can be observed and tested through sensory input. Essentially, knowledge in the form of propositions may be "confirmed or discredited in actual sense experience" (Ayer 1952, pp. 86; 93–94). In this sense, the empiricist believes that "data in the form of observations and experiments comprise the foundation of all knowledge claims" (Schwandt 2007, pg.84).

The disagreement between rationalists and empiricists is primarily concerned with the sources of our concepts and knowledge. The fundamental difference is that rationalist "appealed to rational and formal reasoning, and the empiricists appealed to sensory perceptions" (Baillie 2003, pg. 94). Overall, both rationalist and empiricist views of knowledge seek permanent, indisputable facts which are reasoned and the other in sense experience. Nonetheless, both variations of foundationalism provide for an objectivists stance with regards to knowledge. In this approach, knowledge is external to the mind of social actors and therefore they maintain an objective and independent stance.

Furthermore, and more distinctively, knowledge is only valid and accepted if the phenomena are observable and measurable.

The contrast to foundationalism, represents an interpretive turn to that of empiricism and rationalism, which “disallow the existence of an external objective by itself reality independent of an individual” (Costantino 2008, pg. 116). This turn was influenced by the work of Wilhelm Dilthey [1833–1911], Edmund Husserl [1859–1938], Alfred Schutz [1899-1959] Michel Foucault [1926–1984], and Jean Piaget [1896-1980] and others.

Piaget (1950) like Kant [1724–1804], held that knowledge was within the human mind, but Piaget did not consider knowledge to be *a priori* but rather viewed them as the outcome of the interaction between the mind and environment. This view of Piaget suggest that individuals construct knowledge and they seek to continually assess and transform these constructions based on social interactions and experience in their environment.

In other words, the constructivist stance is that empirical data alone cannot provide the foundation for knowledge which is unencumbered by the interpretation of individuals. Instead, each individual construct knowledge and his or her experience through social interaction. Key factors such experience, beliefs, attitude, language, culture and history would inevitably influence the construction of that knowledge. Hacking (1999) argues that “the constructivist seeks to explain how human beings interpret or construct some X in specific linguistic, social, and historical contexts”.

This view of epistemology has led to a subjectivist stance where the researcher believes that knowledge is based on the perception of the individuals and attempts to minimize the distance between themselves and the phenomena being researched. Additionally, the subjectivists' stance purports that knowledge is not independent of the social actors but rather knowledge is accepted through the lens of social actors.

4.2 Research Paradigm

These philosophical positions have led to two dichotomous paradigms in social and business research (Guba and Lincoln 1994), these are positivism and interpretivism (constructivism).

Positivism has its roots in natural science and was the prominent philosophy for social scientists during the early twentieth century. Positivists "believe in empiricism: the idea that observation and measurement are the essence of scientific endeavour" (Eriksson and Kovalainen 2008, pg.11). This involves the separation of theories from observable facts so that the truth of theories can be tested in a world of these independently existing facts (Seale 1999, pg. 23). Therefore, positivism is based on a realism ontology and the foundationalists' epistemology of empiricism. In other words, before knowledge can be considered acceptable, theories must be subjected through rigorous testing. Therefore, a "positivist statements would be directly verifiable as true or false by their correspondence with the facts" (McLaughlin 2012, pg. 24).

Positivism is akin to the quantitative research approach (Creswell 2009), whereby under this view, "real causes of social scientific outcomes can be determined reliably and validly" (Johnson and Onwuegbuzie 2004, pg. 14). In other words, quantitative research involves testing theories objectively by investigating the causal relationship among variables (Creswell 2009). This means that the researcher is independent of that which is being researched and as such seek to measure the phenomena factually. According to Bryman (1984) surveys and questionnaires are the preferred instruments to be used under the positivist assumptions since it ensures objectivity, replication and content validity can be checked. Furthermore, causality can be analysed, this facilitates the testing of theories based on an interrelated set of constructs that form the basis for hypotheses which is a key feature of quantitative research (Johnson and Onwuegbuzie 2004).

Positivism has not been without contradiction from social science researchers who argue that “the positivist philosophy cannot account for the interaction between theory and fact” (Seale 1999, pg. 21). Additionally, interpretivist’s such as Schutz (1970) claims that the positivists approach creates an oversight to human subjectivity. Also, Popper (1980) rejects the claim that through science a theory can be justified or verified indubitably as purported by rationalist. Popper (1980, pg. 47) states “there can be no statements that cannot be tested, and therefore none that cannot in principle be refuted, by falsifying some of the conclusions that can be deduced from them”. In essence, Popper is suggesting that positivism’s view of knowledge are generalizations deduced from the testing of theories which have not been refuted to that point. This Popperian view is an example of post-positivism and represents a turn in philosophy, where theory must always be tentative since it can be challenged.

Essentially, interpretivism rejects the view of positivists that science can be applied to the study of issues surrounding human behaviour and society in a similar way to that of objects of nature (McLaughlin 2012, pg. 28). Contrary to positivism, interpretivism holds the view “that the researcher must enter the social world of what is being examined” (Wilson 2014, pg. 12). In other words, the interpretivists researcher integrates the views of humans in order to understand the world in which they are researching (Creswell 2009). Therefore, according to Eriksson and Kovalainen (2008 pg. 19) the interpretivist is “interested in how people, as individuals or as a group, interpret and understand social events and settings” and as such will in most cases interact with the participants of the research.

Interpretivism takes on the subjective view of the ontological and epistemological philosophical assumptions. That is, it is based on the ontological position of idealism, which asserts that reality does not exist independently of our minds (Schwandt 2007, pg. 144) and that the social actor’s reality is a projection of human imagination derived from experiencing the phenomena directly in a local and specific context (Guba and Lincoln 1994). This leads to many realities as there are many social actors involved in the research and therefore rejects the positivist view of one truth and one reality as concrete. This view is confirmed by Johnson and Onwuegbuzie (2004, pg. 14) who stated interpertivists “contend that multiple-constructed realities abound, that time and context-free generalizations are neither desirable nor possible”.

Following on from the subjective ontological stance, the other philosophical base of interpretivism is that of subjective epistemology. The interpretivist believes that knowledge and “meanings are constructed by human beings as they engage with the world” (Creswell 2009, pg. 8). More pointedly, as elucidated by Guba and Lincoln (1994) the distinguishing features of ontology and epistemology fades, since just as reality is constructed, knowledge too is built up and constructed in the minds of the persons involved the research who are interdependent. Moreover, these multiple projections of reality and constructions of knowledge from historical experience are then transmitted between individuals over time (Alvesson and Skoldberg 2009, pg. 27).

From a philosophical level, interpretivism has been equated with the qualitative research approach, since Bryman (1984, pg. 77) suggests that qualitative research "is a commitment to seeing the social world from the point of view of the actor". Therefore, it shares the same philosophical basis as interpretivism.

In summary, the characteristics of the two main dichotomous research paradigms in terms of its underlying philosophical is shown in Table 4.1 below.

	Positivism	**Interpretivism**
Ontological Orientation	Realism	Idealism
Epistemological Orientation	Empiricism	Constructivism
Research Approach	Quantitative	Qualitative

Table 4.1 Fundamental Paradigm Differences

Having debated the paradigm options and its philosophical basis, the researcher now turns to the choice of research paradigm and justification.

4.3 Researcher's Philosophical and Paradigm Choice

On the basis of the above enlightenment of the various research philosophies and the fundamental differences between Positivism and Interpretivism as discussed above.

The researcher **did not use a positivist belief.** This choice is based on the researcher's view that there is no a single truth or absolute truth about the phenomena mobile learning adoption to be discovered. The basis of this view is that students need to be active learners not passive learners, and knowledge should be constructed based on the student experiences, these views are shared by Freire (2010), Piaget (1970) and Vygotsky (1978) to name a few.

To this end, the success or failure of mobile learning adoption in private higher education is dependent on the perspective of the individual and group of learners, that is, the students. This view is critical as the intent of the researcher is to evaluate the behavioural intention of adult learners to adopting mobile learning and their mobile learning preference for a constructivist environment, it is therefore essential to obtain their perspective.

In addition, it is the view of the researcher that the development of a mobile learning pedagogy must meet one important requirement, that is, it must be student driven. There must be a connection between the student's preferred style of learning and the teaching style. This view is supported by Freire (2010) who suggested the need for an authentic dialogue between the teacher and the learner. Schon (1987) also advocates for the reconnecting of these aspects of pedagogy, teaching and learning through reflective practice, where practitioners actively evaluate the impact of their pedagogical approaches on their learners.

In addition, most of the previous technology adoption research focused on the technological factors for adoption using the traditional TAM and therefore used a positivists assumption. Given that this research focused on evaluating the motivational and pedagogical factors for mobile learning adoption, the researcher **adopted the use of interpretivism**, which is based on an idealist ontological position and a constructivist epistemological stance (See Figure 4.3 below). This view is held since the students are situated in a particular social and cultural context which will have implications for the pedagogical approach by teachers and the adoption of mobile learning by students. Therefore, there will be multiple views/realities of the phenomena (mobile learning) based on each individual or group of students and their socio-cultural context. Furthermore, these realities would be a projection of their experience of learning within their mind.

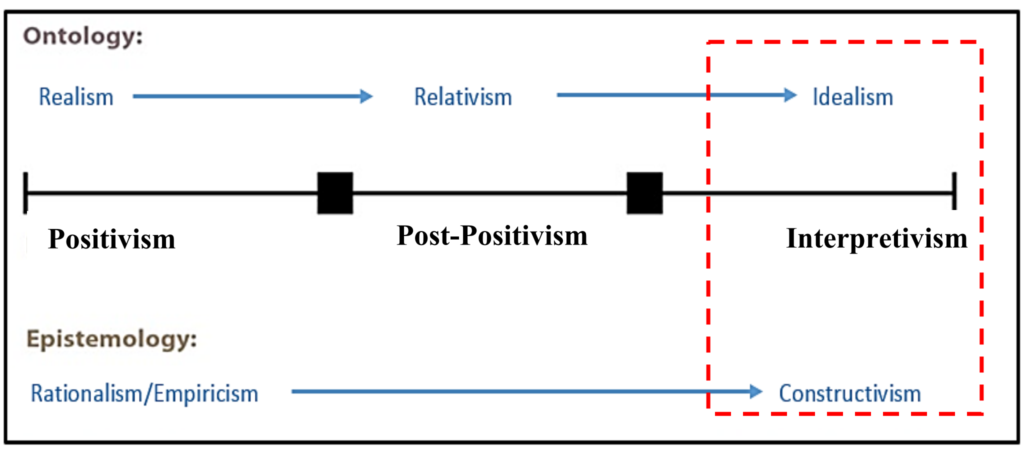

Figure 4.3 Researcher's Chosen Research Paradigm

Moreover, the researcher did not see the participants (students) as independent and detached from the research, since the researcher holds the view that the success of mobile learning adoption must be based on experiences of learners (Andrews et al 2010 as cited by Alrasheedi and Capretz 2015, pg. 43). Hence, the researcher sort to minimise the distance between student and researcher by using an Action Research methodology.

4.4 Action Research Methodology

In light of the chosen research paradigm of interpretivism, consistency was maintained through the use of **Action Research (AR).** This view is supported by Greenwood and Levin (2007, pg. 54) who stated “epistemologically, AR rests on the premise that reality is interconnected, dynamic, and multivariate”. This is concurred by Norton’s (2009, pg. 54) interpretation of the seminal work by Carr and Kemmis (1986), purporting that positivism is inappropriate since “educational issues are inevitably messy and ill-defined and take place in a complex context”.

The researcher contends that in order to understand the way mobile learning will be adopted and more importantly, how it can change the teaching practice for adult learners, a conversational relationship between theory and practice was imperative. The researcher therefore focused on using the findings from practice to develop a proposed theoretical model on the adoption of mobile learning. From which, the implications to the teaching and learning would then be subsequently incorporated into practice during future action research cycles.

This is in keeping with the view of Efron and Ravid (2014, pg.2) who stated “action research is usually defined as an inquiry conducted by educators in their own settings in order to advance their practice and improve their students’ learning”. Furthermore, Action Research afforded the researcher the process to overcome the criticisms and assumptions of TAM, in that it was based on a self-reported use, not actual use.

Essentially, the idea behind the research was to bring about changes through action, in the current teaching and learning practice based on the researcher's experience of using technology enhanced pedagogy over the past sixteen (16) years through a bottom- up, democratic process. This view is supported by McNiff and Whitehead (2002, pg.13) who opined that action research should not be seen as concrete steps "but as a process of learning from experience, a dialectical interplay between practice, reflection and learning".

Inevitably, Action Research provided the researcher with an avenue for the democratic process to be fulfilled, since AR is triggered "with a research question and ends with the application of the knowledge gained" (Efron and Ravid 2014, pg.7). Through the process of reflection, this knowledge can be further advanced by developing new propositions and questions, thereby prompting new cycles of research as shown in figure 4.4 below (McNiff and Whitehead 2002).

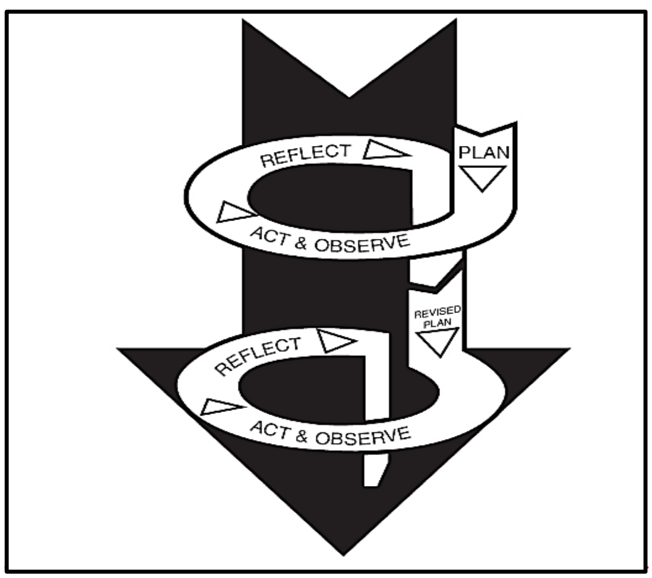

Figure 4.4 The Action Research Process
Source: Kemmis and McTaggart (1981)

This process of reflection when applied to an educational context promotes the notion Freirean pedagogy which necessitates a ‘‘dialectical movement which goes from action to reflection and from reflection upon action to new action’’ (Freire 2010, p. 31). This concept is supported by Kane and Chimwayange (2014, pg. 54) who states that action research affords “teachers to situate research within their own evolving classroom practice”. In essence, through the use of action research for this study, the researcher was able to take advantage of the changes to the teaching and learning practice between the researcher acting as a practitioner and the students involved as contributors (Lingard, Albert, & Levinson 2008).

Moreover, the use AR in relation to improving technical skill and the facilitation of learning new technological intervention for pedagogy is difficult to overstress (Gibbs et al 2017). As such, it is not an uncommon approach for making interventions of new pedagogies in teaching and learning practice as it “provides an ongoing methodology for exploring how these educational interventions help engender changes” (Glassman, Bartholomew, and Hur 2013, pg. 338). Furthermore, it is well suited for research in technology enabled pedagogy as suggested by Kim (2009, pg. 432) who stated “action research has been reported to be an effective research method for technology implication studies”. Thus, the outcome of action research leads to improvement in teaching and learning practice, but more importantly contributing to the development of theoretical knowledge (Norton 2009).

In addition, by using AR, the research question of **how can the adoption of Mobile Learning be used to augment the pedagogical strategies currently used for adult**

learners in the private higher education sector in Trinidad? can be examined through reflection and responses from the participating students in the AR project described below.

4.5 The Action Research Project

The AR project provided an opportunity for the researcher to play a dual role, firstly as a practicing academic and secondly, as a doctoral researcher at the same institution. The researcher implemented the use of a mobile application as an intervention (agent for change) to augment the teaching and learning practice for adult learners at a private higher education institution in Trinidad. Through this intervention, the researcher was able to capture the reflection of students who participated in an active mobile learning environment. This provided insights into the students' behavioural intentions to adopt mobile learning. This process is consistent with the views held by McNiff and Whitehead (2002) and Kemmis & McTaggart (2005).

In essence, the use of an AR approach allowed the researcher to operationalize the research objectives, in summary; to evaluate the motivational and pedagogical factors that influence behavioural intention for adoption as well as the preference towards a constructivist mobile learning environment. Since the researcher was able to draw upon the reflections of the epistemological shifts made by the students from using the mobile learning environment.

The following section in this chapter will provide further insights on the application of the AR process used for this research.

4.5.1 Planning Phase

In this study, the researcher used a single loop learning process as suggested by Argyris et al. (1985) since the action research project was used as a means-end reflection on human action (Greenwood 1998, pg. 1052). In other words, the action strategy involved the implementation of a mobile learning environment as a means of evaluating the participating students' intention to adopt mobile learning (the end) based on their reflection from actual use as shown in Figure 4.5 below.

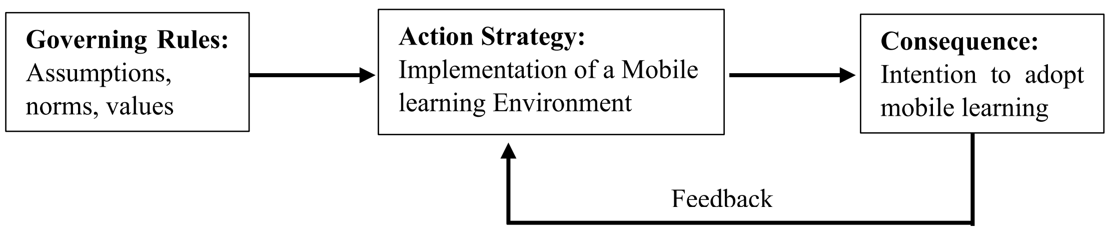

Figure 4.5 The Action Research Process- Single Loop
Source: Adapted from Tagg (2010)

According to Tagg (2010) single loop learning will usually be sufficient to make theories in use, as defined by Schon (1987), explicit through reflection on action. The researcher did not subscribe to a double loop learning since it involves reflection on the assumptions, values and norms in addition to the action strategies used (Greenwood 1998, pg. 1049). This would have been difficult to achieve as the researcher was not in a position to change the assumptions and governing rules for the design of a mobile learning environment, such as the curriculum and courses delivered as these are based on the foreign university partnering with the private higher education institution.

The planning phase also focused on identifying the participants for the action research project. The project's participants were drawn from Masters of Business Administration (MBA) programme delivered at a private higher education institution, since the study was focused on adult learners whose learning space not only involves the formal intentional learning space of the classroom but also the informal learning space of work and home. The project entailed delivering two (2) modules of the MBA programme to three (3) cohorts of students during the academic year 2016-17.

The operationalization of the action research project involved two (2) stages within the single loop. The first stage, involved the participation of 2 cohorts of students enrolled in May 2016 (Cohort 1) and September 2016 (Cohort 2). During this loop two (2) modules were delivered as follows; the Project Management module was delivered to Cohort 1 and the Research Methods module was delivered to Cohort 2, independently, incorporating a mobile learning environment. The second stage involved participants enrolled into the MBA programme in February 2017 (Cohort 3). During this loop the Project Management module was delivered to Cohort 3.

The researcher used a two-stage approach, with three (3) independent cohorts and 2 independent modules in order to improve generalization of the findings and also to reduce the likelihood of student response-bias and insider-research bias, which are common limitations of educational action research (Gibbs et al 2017).

In summary, the general idea behind the project was to allow the students to experience a working mobile learning environment, so that they can reflect on their experience when providing feedback. Further, mobile learning is a relatively new concept in Trinidad and students have not been exposed to it in the private higher education sector, which can be a limitation with regards to quality of the research results. Thus, the researcher, through the project, ensured that the students appreciated and gained a better understanding of a mobile learning environment. This will allow the students to provide more reliable feedback as they would be better positioned to understand and interpret the constructs used in the research instrument during the evaluation phase.

The next phase in the action research process involved the action phase, where the intervention was implemented.

4.5.2 Action Phase

The researcher ensured that the students enrolled in the 3 cohorts were informed about the purpose of the project at the start of the respective trimester. This was done during the initial lectures at the beginning of the trimester and through the researcher's website doctoral page http://www.samuellearning.org/dba.html. The students were also informed that their participation in the project is voluntary.

In order to setup the mobile learning environment, the researcher designed and developed of a mobile application, called the **SAM Learning 2 Go (SL2G) Project** for the two (2) MBA modules Project Management and Research Methods (see Figure 4.6 below).

The mobile application provided students with course material, handouts and other useful course information (see Figure 4.7 below) which they can access outside of the formal classroom environment. In addition, to the mobile application, the researcher provided timely support to students using emails and other publicly available mobile applications. In addition, learning activities such as quizzes and case studies with questions were sent to the students via email and also released through the mobile application.

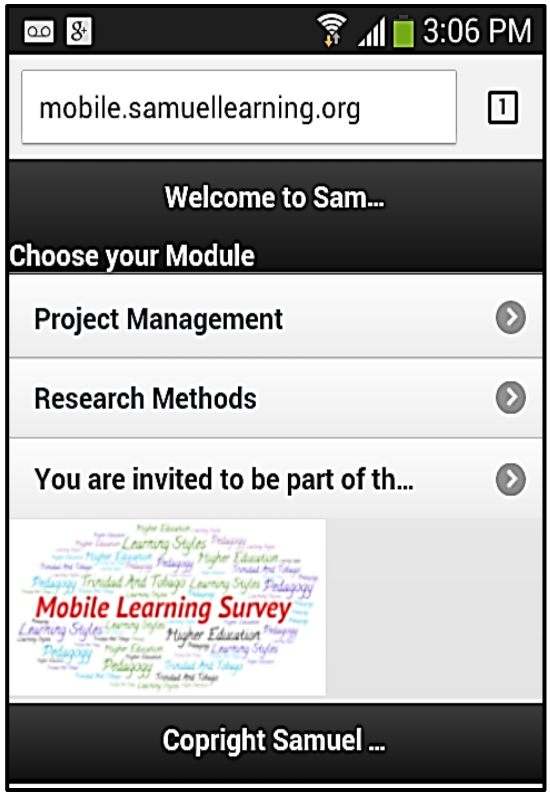

Figure 4.6 SL2G Welcome Screen

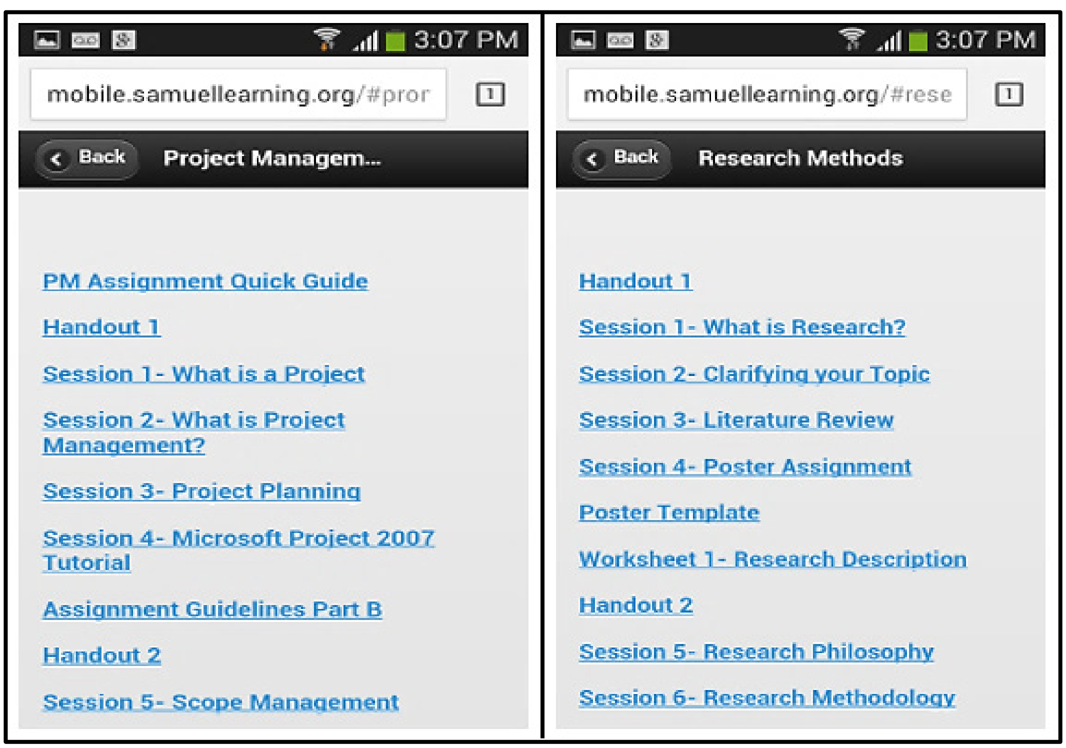

Figure 4.7 SL2G Module Pages

Furthermore, the SL2G project involved creating a space online for students to collaborate outside of the traditional classroom and learning time. The collaborative activities were executed using messaging applications as well as video conferencing applications.

Additionally, the researcher used remote lectures as well to deliver the course material using a video conferencing application (see Figure 4.8 below). This allowed students to join the lecture from locations in the informal learning environment, for example; at home or work. The chat feature was also used during these online lectures to facilitate feedback and inquiry. The researcher was also able to share presentation of slides and annotate while providing a discussion.

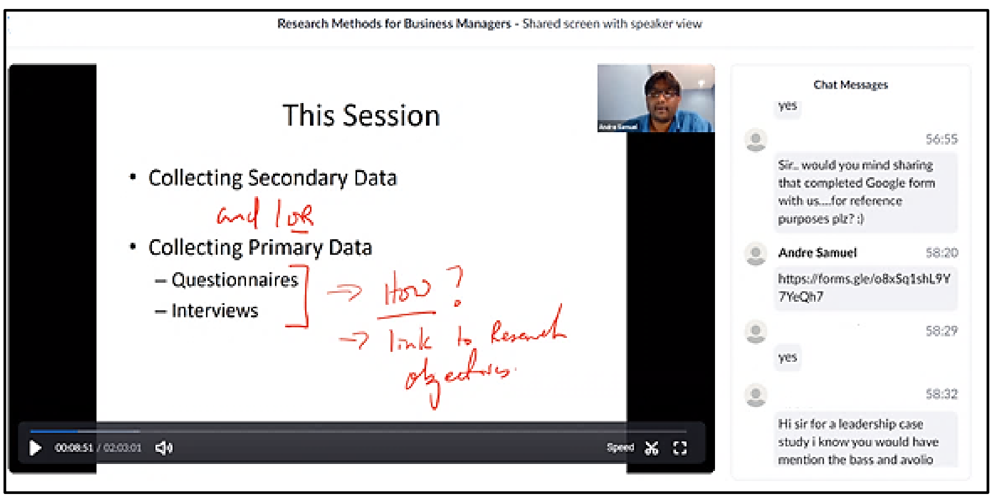

Figure 4.8 Remote Lecture using Video Conferencing Application

The duration of the action phase, that is, period of usage of the mobile learning environment by each cohort was one trimester during the study. So, in summary, the first stage started September 2016 and ended December 2016. During this stage there was participation from cohort 1 and cohort 2 with regards to the Project Management and

Research Methods module respectively. During the second stage, cohort 3 participated using the mobile learning environment for the Project Management module.

Overall, there were more than 500 new users of the mobile application during this period, with almost 3000 page views from roughly 1500 sessions (visits), that is, an average of 2 page views per visit as shown in Figure 4.9 below.

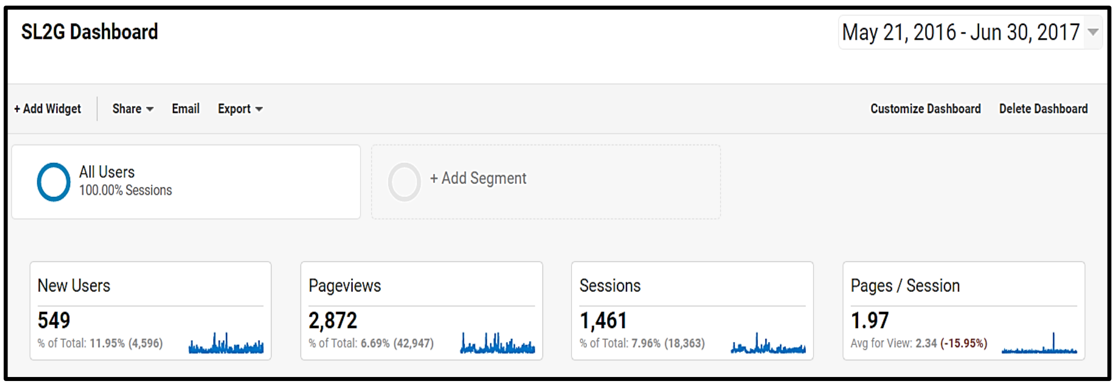

Figure 4.9 SL2G Usage Report 2016-17

4.5.3 Reflection and Evaluation Phase

Reflection has been recognized as a distinctive feature of action research so much so that Carr and Kemmis (1986) has described it as reflective practice (Luttenberg et al 2017). According to Leitch and Day (2000, pg. 180) "reflection is considered as a process or activity that is central to developing practices". Furthermore, reflective practice not only empowers academics to learn from their experience and tacit knowledge but "to stop, look, and discover where they are at "that moment and then decide where they want to go (professionally) in the future" (Farrell 2012, pg.7). Moreover, reflection in principle facilitates the conversation between theory and practice (McAteer 2013), but more importantly, reflection sheds light on the tensions and contradictions between theory and practice (Luttenburg et al 2017). The literature reveals that the seminal development of reflective thinking is associated with Dewey (1933) and then later by Schon (1983). Schon

(1983) extended the concept of reflective thinking by Dewey by articulating two forms of reflection; reflection on action and reflection in action (Leitch and Day 2000).

On the one hand, according to Olteanu (2017) reflection in action occurs during the action phase. In addition, Benade (2015) asserts that this type of reflection involves on the spot analysis and constantly “modify ongoing practice in such a way that learning takes place” (Leitch and Day 2000, pg. 180). The ongoing modification of the actions is as a result of the practitioner’s ongoing process of thinking which is stimulated by the need to resolve problems and puzzles (Greenwood 1998).

On the other hand, Schon (1983) referred to reflection on action as a postmortem of the change implemented. In other words, reflection on action takes place after the occurrence of the action (Olteanu 2017). Furthermore, Benade (2015, pg. 44) argues that this type of reflection “takes more time, and involves looking at evidence, thinking about theories and alternatives”.

In this study, the researcher focused on the use of reflection on action, as such, the researcher utilized a retrospective analysis of the intervention implemented (Leitch and Day 2000) from the participating student’s perspective. The researcher was therefore able to capture the reflections of students who participated in an active mobile learning environment in terms of their behavioural intentions to adopt mobile learning.

So, in terms of executing the reflection phase, the idea was to attain student feedback on their views and perceptions regarding their intentions to adopt mobile learning, after using the SL2G, at the end of the respective trimesters as shown in Table 4.2 below.

Cohort	Data Collection Period	Trimester
1- May 2016	November to December 2016	2016-17 Tri 1
2- September 2016	December 2016 to January 2017	2016-17 Tri 1
3- February 2017	April 2017 to May 2017	2016-17 Tri 2

Table 4.2 MBA Cohorts and Data Collection Period

The feedback from the participating students focused on the determinants of mobile learning adoption and the implications for the teaching and learning practice based on their propensity towards a constructivist learning environment. Therefore, the SL2G's main purpose and value is embedded in the mobile technology affordances that the students experienced while participating in a working mobile learning environment. This affordance allowed the students to reflect on their experience when providing feedback. As such, the feedback captured, reflected the epistemological shifts made by the students during the period of usage of the mobile application and the mobile learning environment developed. This is important in light of Baggozi (1981) suggestion that experience can influence behavioural intention. Furthermore, by allowing the students to experience the mobile learning environment, the researcher sought to reduce their cognitive bias towards mobile learning, which may arise due to false inferences and stereotypes (Marchiori and Cantoni 2015). In other words, through the SL2G intervention, the researcher moved to reduce the potential misunderstanding of mobile learning within the students' mind. Thus, enabling students to make the ontological shifts necessary to understand the concept of mobile learning. This view is supported by Sellier et al (2019, pg. 1377) who argued that interventions can reduce the influence of cognitive bias.

According to Benade (2015, pg. 44) “the outcome of reflection must be changed practice”. So, in terms of the implications to practice, the reflection resulting from this study provided the basis for first order change and innovation (Tagg 2010) to technology enhanced learning at the participating private higher education institution (see figure 4.10 below). This was accomplished through the use of staff development at the participating institution during the period May to August 2020. Since, the use of staff development as a means of transferring the theory developed from the action research into practice is a widely recognized approach (Newton and Burgess 2008; Gibbs et al 2017).

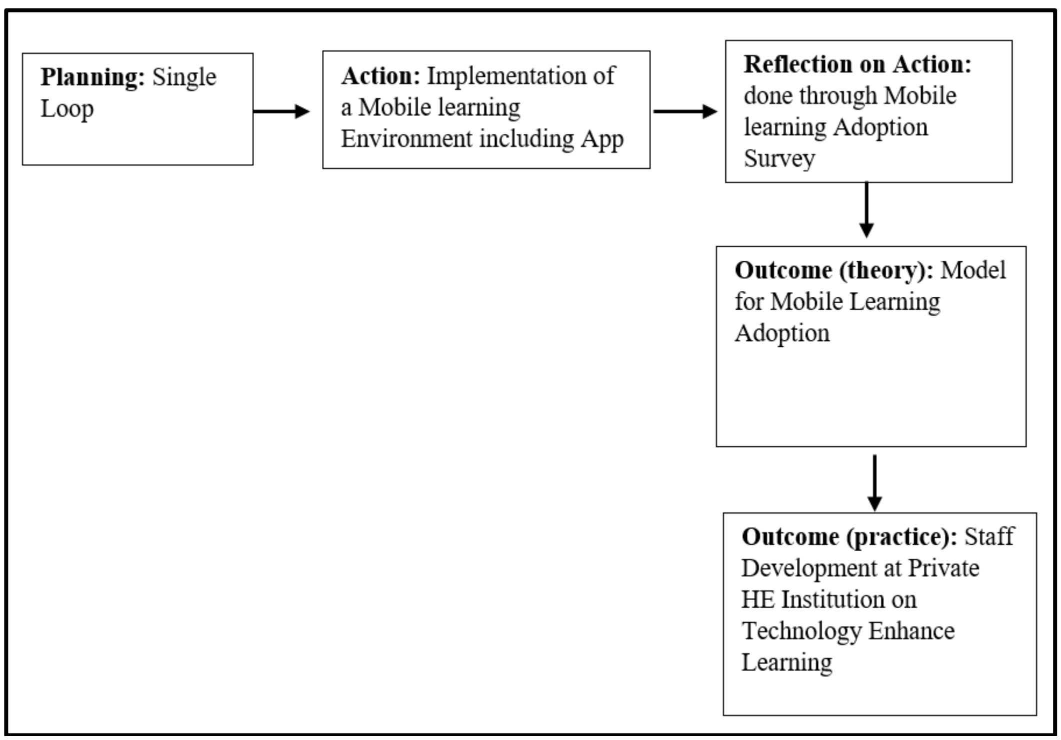

Figure 4.10 Summary of the Action Research Methodology

Furthermore, this action research project was used as a catalyst for future cycles of action research as educational institutions seek to make a paradigm shift (Tagg 2010; Gibbs et al 2017) by implementing mobile learning into the formal learning environment. In other words, the subsequent formal and institutional interventions required to change the teaching and learning practice so as to heighten the learner's adoption of mobile learning can be formulated on the basis of the proposed model for mobile learning adoption developed from this research, which will lead to new actions and future cycles of reflective practice.

It is worth noting that for this study, reflection in action as defined by Schon (1983) was not applied to this research as it was not within the scope of the action research project. More importantly, the use of reflection on action was sufficient to facilitate the achievement of the research objectives.

Furthermore, the reflections undertaken were not geared towards continually modifying the mobile learning environment whilst the action research project was in progress (Leitch and Day 2000). The researcher asserts that this approach to reflection would have obscured the main intention of the research and affect the planned outcome of the action research (Luttenberg et al 2017, pg. 89). That is, to use student feedback for the development of a technology enhanced learning policy and to drive change at an institutional level (Coghlan and Miller 2014). Additionally, to use the proposed model for mobile learning adoption as a means for strategic planning at the private higher education institution (Dalvi-Esfahani et al 2020).

In light of this, the researcher used a quantitative research method for collecting the feedback from the students since it is instrumental to influencing institutional change (Lomer and Anthony- Okeke 2019, pg. 620). Moreover, the use of qualitative methods inherent in the use of reflection in action, would add further complexity to the unsettling nature of the reflection. In that, it will result in disruption to the learning environment as it would involve for instance, continuously interviewing students who participated in the SL2G project during scheduled teaching sessions. This is especially important as the researcher was bounded by this explicit ethical criterion when obtaining approval from the participating institution. Also, by his fiduciary responsibilities to ensure that the students are not place at a disadvantage in terms of their academic performance on the course (Gibbs et al 2017).

Furthermore, in the face of criticism that action research is too focused on discussing and analysing the reflective process based on practitioner and student reflection (Gibbs et al 2017), which is often captured using qualitative methods such as observations and interviews. The researcher sought to counteract this insider research bias by focusing on a retrospective evaluation of the intervention through the use of a mobile learning adoption survey, thereby eliminating the over dependence on the moral values of the teacher-researcher and the student (Luttenberg et al 2017).

In summary, according to Efron and Ravid (2014) the choice of research methods for action research should be based on the research question at hand, the focus of the study as well as the prevailing settings and context of the research. Given, the argument articulated, the researcher's use of a quantitative method was based on integrating the ethical issues into the research design early, as well as to overcome the limitations of using educational action research to answer the research question. Therefore, a quantitative method was used to increase participant response rates and to treat with the ethical challenges of insider research inherent in action research using qualitative methods (Lomer and Anthony- Okeke 2019) and respecting the rights of the participants. Moreover, the use of a quantitative method, which was operationalized using the mobile learning adoption survey, resulted in strengthening the validity and generalization of the findings derived from the research due to its ability to capture the voice a large sample of the student that participated in the action research project.

Therefore, the following section will provide further insights into the procedure used to collect the required data for this study.

4.6 Research Methods

This section of the chapter will provide the insights on how the research objectives were operationalized for this research, essentially explaining how the student feedback was obtained from the action research project. It is however, important to further justify the choice of research method based on an epistemological argument prior to providing the discourse on the data collection procedure.

There have been many debates about the use of quantitative and qualitative paradigms and more importantly when their use is appropriate in a study. This have been called the 'paradigm wars' as the debate "has oscillated between philosophical and technical levels of discussion" (Bryman 2006, pg. 111). The debate has been centered on two distinct levels, firstly based on the epistemological and ontological assumptions and secondly on the level of data collection and analysis. In reference to the former level, purists' researchers advocated that the quantitative and qualitative research paradigms are not compatible, the so called incompatibility thesis (Howe 1988). Furthermore, they linked the philosophical level with the technique level, therefore choice of methods must be consistent with the respective paradigm, further exacerbating the incompatibility thesis (Johnson and Onwuegbuzie 2004; Teddlie and Tashakkori 2010).

However, the incompatibility issue has been largely resolved over the years (Bryman 2006, pg. 113) and has been rejected "based on criticism of the interlinking of heterogeneous assumptions under the umbrella of what constitutes a paradigm" (Teddlie and Tashakkori 2010, pg. 13). This has inevitably led to a school of thought in contemporary research, that research methods and techniques for data collection and analysis can be self-determining from their conventional philosophical assumptions (Bryman 2006). This view is supported by Hammersley (1992, pg. 142) who stated that "philosophical assumptions do not have strongly determinate implications for how we should carry out research". In addition, Guba and Lincoln (1994, pg. 105) opined that "both quantitative and qualitative methods may be used appropriately with any research paradigm". So, in essence, it is not compulsory nor automatic to utilize a research method that subscribes to the research's epistemological assumptions, nor can techniques be superior to others on the basis of philosophical assumptions (Bryman 1984). Moreover, Johnson and Onwuegbuzie (2004, pg. 15) postulates that the justification of epistemological assumptions should not prevent a researcher from using a research method that is conventionally conflicting. The critical criteria elucidated by Bryman (1984) suggests that the method chosen must be appropriate based on the research problem and the context of the study.

In light of the above discussion, this research was completed using a cross-sectional **Online Questionnaire** as the method for collecting the data needed to achieve the research objectives:

1. To evaluate the motivational factors that influence behavioural intention of adult learners to use mobile learning.

2. To evaluate the pedagogical factors that influence behavioural intention of adult learners to use mobile learning.

3. To explore the mobile learning preferences of adult learners based on constructivist learning.

4.6.1 Justification for using Online Questionnaire

In addition to the above justification from a methodological and philosophical standpoint, the researcher used an online self-administered questionnaire due to the research purpose and context.

Firstly, in relation to the research context, given the use of Action Research and need to collect data multiple times during the study, the questionnaire was able to facilitate replication without the issue of variability, reliability and content validity as the items for the constructs and its measurement were held stable throughout the data collection process (Bryman 1984). Additionally, in terms of the size of the population, the practicality of the questionnaire allowed for the data to be collected in a timely manner as the questionnaire was distributed to a large number students taking part in the research using emails at the same time (Bryman 2016). Furthermore, there was no disruption to the learning process as students were able to complete the questionnaire at their own time and place. Moreover, it was also appropriate with regards to accessing the participants, as convenience was afforded to the respondents, which is a key consideration given that the participants were adult learners.

Secondly, in terms of the research purpose, that is, for the evaluation of the effects of motivational and pedagogical factors on behavioural intention of students to adopt mobile learning, questionnaires are well suited. Since as postulated by Creswell (2009), through questionnaires effects and relationships can be analysed by using well established statistical techniques such as multiple regression analysis and structural equation modelling to investigate the causal paths and its direct and indirect effect on the dependent variable. These analyses can then form the basis for making generalizations from the sample population (Collis and Hussey 2009).

In light of the above justification, the following sections will provide a detailed discourse on the procedure used for data collection, sampling, response rate and non-response bias. Additionally, details of the instrument design will be discussed as well as the data analysis procedure utilized.

4.6.2 Participants and Procedure

The study was conducted at a private higher education institute, among Masters of Business Administration (MBA) students. The study employed the use of a non-probability sampling method, that of convenience sampling. According to Bryman (2015, pg. 187) "a convenience sample is one that is simply available to the researcher by virtue of its accessibility". This is the case for this research as the researcher selected to use students enrolled in the MBA programme for the action research, based on access provided by the institution. Whilst this can be seen as a limitation in terms of sample representativeness, Frey (2018) suggests that by ensuring that the sample is relevant to the study and by comparing the demographic profile of the sample population to that of the relevant population, this shortcoming can be mitigated. Therefore, the researcher performed a comparative analysis of the demographic profile of the students who responded to the mobile learning adoption survey to that of other higher education institutions in Trinidad, namely The University of the West Indies and the University of Trinidad and Tobago to demonstrate population representativeness of the findings. This was conducted in the analysis and discussion chapter. Furthermore, the selection of MBA students for the sample is fitting since they are adult learners who are studying part time, which were two criteria used for scoping and contextualizing the research. Moreover, convenience sampling was appropriate for this study since the researcher did not have access to a list of students (Frey 2018) at the private higher education institution due to need to protect the privacy and confidentiality of the student's personal data. Thus, the use of probability sampling such as random sampling was not applicable to this study.

Data was collected through the distribution of an online self-administered questionnaire, to the three (3) cohorts of MBA students who voluntarily participated in the SL2G project during the period September 2016 to May 2017. Given that the study utilized a convenience sample from each of the cohorts that participated in the SL2G project, the web link to the mobile learning adoption online questionnaire was emailed from the MBA programme administrator to five hundred and forty-eight (548) eligible students across the cohorts at the appropriate times (see Table 4.3 below) inviting them to participate in the survey (see sample of email in Appendix 4). In addition, the researcher created a doctoral webpage on his website (http://samuellearning.org/dba.html) which also invited the MBA students enrolled for the academic year 2016-17 to participate in the online questionnaire, a link was also placed on the SL2G mobile application as shown in Figure 4.6 above.

MBA Cohort	Population	Sampled	Data Collection Period
May 2016	92	55	November to December 2016
Sept 2016	314	243	December 2016 to January 2017
Feb 2017	142	47	April 2017 to May 2017
Total	**548**	**345**	

Table 4.3 Sampling for Online Questionnaire

Additionally, the researcher through the MBA programme administrator sent email reminders to the respective cohorts during the period that the online questionnaire was active.

There was a total of three hundred and fifty-five (355) responses, however after inspection, ten (10) of the responses were discarded due to an incomplete response set due to the student choosing no to the consent question. This resulted in three hundred and forty-five (345) useable responses, in other words, a response rate of sixty-three percent (63%). Since this is above the calculated sample size of three hundred and one (301) given the known population, it means that the survey results are within five percent (5%) margin of error and the probability that the sample represents the population, that is, the confidence level is ninety-nine percent (99%).

Furthermore, according to Fincham (2008) researchers should aim for approximately 60% response rate as this meets the threshold of most editors of journals, this study has surpassed the benchmark with 63%. In addition, whilst not a guarantee, a higher response rate reduces the likelihood of non-response bias and therefore improves the credibility of the survey results (Dillman 2014, pg. 6). Moreover, this study's response rate was well above the traditional response rate of 20% to 30% for student surveys in a university (Dillman 2014, pg. 23).

4.6.3 Instrument design

The questionnaire was designed to operationalize the research objectives, as such the constructs or scales chosen reflected the data needed to achieve the research objectives. These scales for the mobile learning adoption (MLA) online questionnaire were derived from the literature review and were contextualised to the mobile learning context in order to achieve content validity. The instrument was designed with twelve (12) sections to represent the required scales to measure the motivational factors, pedagogical factors, mobile learning preference and behavioural intention for adoption, as well as demographics and mobile usage of adult learners (see complete questionnaire in Appendix 2).

In relation to objective 1; to evaluate the motivational factors that influence behavioural intention of adult learners to use mobile learning. The questionnaire consisted of three (3) sections for cognitive need, affective need and social need based on Uses Gratification Theory. These scales consisted of three (3) items each and were derived from the works of Mondi et al (2008), Hashim et al (2014) and Lai et al (2016). Additionally, there were two (2) further sections for self-efficacy and subjective norm as they were included as motivational factors. They consisted of three (3) items each as well, derived from the Technology Acceptance Model (TAM) and the works of Lin et al (2016) and Hao et al (2016).

In addition, for objective 2; to evaluate the pedagogical factors that influence behavioural intention of adult learners to use mobile learning. The questionnaire consisted of three (3) sections for perceived usefulness, perceived ease of use and learning relevance, which were drawn from TAM. The scale items for these scales were derived from the works of Davies (1989), Park et al (2012), Wang et al (2009), Hao et al (2016), Al Emran et al (2016) and Lin et al (2016) and each scale consisted of three (3) items each.

With regards to objective 3; to explore the mobile learning preferences of adult learners based on constructivist learning. The questionnaire consisted of a section for the constructivist mobile learning preference scale, which was developed using five (5) scales, each with two (2) items. These scales were; student negotiation, adaptive content, inquiry learning, timely guidance and continuity. The scales were derived from the works of Chuang and Tsai (2005), Tsai (2008), Tsai et al (2012) and Lai et al (2016).

The questionnaire also consisted of a section to measure the dependent variable of behavioural intention derived from TAM. This scale contained three (3) items derived from the works of Davis (1989), Park et al (2012) and Hao et al (2016).

The scale items in all instances were presented as statements on the questionnaire and were measured using a 5-point Likert scale, ranging from 1 Strongly Disagree to 5 Strongly Agree. Table 4.4 shows a summary of the scales used in relation to the research objectives and the sources they were adapted from.

Research Objectives	Measurement Scales	Source
1. To evaluate the motivational factors that influence behavioural intention of adult learners to use mobile learning	Cognitive Needs	Mondi et al (2008), Hashim et al (2014) and Lai et al (2016)
	Affective Needs	
	Social Needs	
	Subjective Norm	Lin et al (2016) and Hao et al (2016)
	Self-Efficacy	
2. To evaluate the pedagogical factors that influence behavioural intention of adult learners to use mobile learning	Perceived Usefulness	Davies (1989), Park et al (2012), Wang et al (2009), Davies (1989), Park et al (2012), Al Emran et al (2016) and Lin et al (2016)
	Perceived Ease of Use	
	Learning Relevance	
3. To explore the mobile learning preferences of adult learners based on constructivist learning	Constructivist Mobile Learning Preference: - Student Negotiation - Adaptive Content - Inquiry Learning - Timely Guidance - Continuity	Chuang and Tsai (2005), Tsai (2008), Tsai et al (2012) and Lai et al (2016)
	Behavioural Intentions	Davies (1989), Park et al (2012) and Davies (1989), Park et al (2012)

Table 4.4 Measurement Scales and Sources

The questionnaire also included a section to collect demographic data on the students who participated. The researcher ensured that minimal personal data was collected and only data that was relevant was collected. Thus, the demographic section contains categorical questions on gender, age, job status, hours spent on typical life activities such as work, socializing, studying and family. Further to this, the questionnaire also collected data on mobile usage. This section included questions on device ownership, time spent on device, place of most frequent usage, usage of mobile device for personal activities and usage of mobile device for educational activities.

4.6.4 Validity and Reliability of Instrument

Reliability is concerned with the extent to which there is internal consistency in the answers to the variables being measured, that is, the extent to which they are correlated

(Tuckman 1999). Whereas, construct validity seeks to determine the extent to which the scale items actually measure the latent variable as defined (Hair et al 2010).

In terms of ensuring further content validity, the questionnaire scales and their items were verified by consulting various practitioners in the field of teaching and learning from the Anglia Ruskin University (ARU). These practitioners include one professor, a faculty director of teaching and learning and a senior lecturer. Additionally, the questionnaire was also reviewed by senior lecturers of the private higher education institution where the study was conducted, this was done to ensure that local context was addressed in the design of the questions. The outcome of this procedure led to minor modifications to the wording of a few questions and removal of one measurement scale, that is, self-management.

Furthermore, the questionnaire was also pilot tested in September 2016 with one class of the MBA February 2016 cohort, it must be noted that this cohort did not participate in the final study done in the academic year 2016-17. The pilot study was done after receiving permission to access the participants and ethics approval from ARU faculty research ethics panel. The purpose of the pilot study was to ensure reliability of instrument scales as well as to ensure that the students were interpreting the questions in the right context. The analysis of the instrument scales from the pilot study showed that all scales met the criteria for a good level of reliability as the Cronbach Alpha (α) values were above the recommended value of 0.8 (Hair et al 2010). The pilot study in principle utilized the same methodology as the main study and involved a sample 35 students based on voluntary participation using convenience sampling.

In terms of construct validity of the instrument from the main study, confirmatory factor analysis was completed using IBM AMOS version 20 to determine convergent and discriminant validity. All criteria for both convergent and discriminant validity were met, as results for factor loadings, Average variance extracted (AVE) and square root of the AVE met the criteria as defined by Hair et al (2010) and Fornell and Larcker (1981). The results for these statistics are discussed further in Chapter 5, section 5.7.1.

4.7 Data Analysis

The data collected from the online questionnaires was automatically coded into a MS Excel spreadsheet by the online survey tool Google Forms. At the end of the data collection period for each cohort that participated in the research, the spreadsheet was visually inspected to remove missing data due to instances where participants did not agree to take part in the research which led to missing data for the remaining questions. Once the data was sanitized, the researcher then exported the dataset into IBM Statistical Package for Social Sciences (SPSS) version 26 in order to conduct statistical analysis.

4.7.1 Assumptions for the Analysis

This section will treat with three important assumptions that determine the type of statistical analysis that can be conducted, that is, response bias and whether or not the data collected is interval scale, normally distributed and the sample size is large enough.

Firstly, the researcher sought to assess the extent of any of non-response bias. Therefore, the data was examined to determine whether there was any difference in response to the mobile learning adoption constructs between the first cohort (May 2016) and last cohort (Feb 2017) that participated in the research given that their responses were up to six (6) months apart and the subsequent groups can be considered non-respondents to the first group. Non-response bias was examined by using a Mann-Whitney U Test. The results showed that in all the constructs, non-response bias was not an issue. Since the calculated p values is greater than the significance level of 0.05, that is p > .05 (See figure 4.11 below), as such, there is no significant differences between the mean responses among the two cohorts. Therefore, the sample does not reveal any non-response bias.

Test Statistics[a]

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Cog_Need_Scale	1206.000	2334.000	-.590	.555
Aff_Need_Scale	1082.500	2622.500	-1.417	.156
Soc_Need_Scale	1239.500	2779.500	-.358	.720
Sel_Eff_Scale	1279.000	2407.000	-.092	.927
Lrn_Rel_Scale	1247.000	2787.000	-.312	.755
Sub_Norm_Scale	1275.500	2403.500	-.115	.908
Per_Ease_Scale	1083.500	2623.500	-1.419	.156
Per_Useful_Scale	1050.500	2178.500	-1.653	.098
Beh_Intention_Scale	1225.000	2353.000	-.461	.645
CMLP_Scale	1280.000	2820.000	-.085	.933

a. Grouping Variable: Cohort

Figure 4.11 Results of Mann-Whitney U Test- Between Cohorts

Given that the measurement of the scales on the instrument was done using a Likert scale, it is critical that clarity as to how to treat with this type of data be reviewed prior to discussing the use of appropriate statistical techniques. This is necessary as the choice of technique, whether parametric or non-parametric which can be applied is premised on the assumptions that the data is measured on an ordinal or interval scale (Harpe 2015).

The controversy lies in whether or not Likert scale data is indeed ordinal data or interval data (Cohen 2013; Sullivan 2013). On the one hand, early experts such as Stevens (1951 cited by Cohen 2013) suggest that strictly speaking Likert scale data is ordinal and that parametric analyses cannot be applied. However, Norman (2010) rejects this proposition on several grounds and concluded by stating that the violation of the interval scale assumption has insignificant impact on the robustness of the statistical conclusions.

With the intention of shedding light on the controversy, a look at the definition of a Likert scale becomes important so as to get to the root of the issue. According to Harpe (2015, pg. 838) Likert scales are used to measure a phenomenon "by aggregating an individual's rating of his/her feelings, attitudes, or perceptions related to a series of individual statements or items". Furthermore, each item is presented as a declarative statement with a response set of numbers with anchors such as strongly agree, agree and so on. As Harpe (2015, pg. 839) reports, the original Likert scale proposed equal spaces between the numbers and between the anchors in the response set. Furthermore, Cohen (2013) proposed that the individual responses to a set of Likert scale items be converted into a single score by using the mean of the coded responses, in so doing the Likert scale becomes interval data (Harpe 2015). This view is supported by Norman (2010. pg. 629) who stated that "Likert scales, consisting of sums across many items, will be interval" much like the total score of correct answers in a test is treated as interval data. In addition, individual scale items should hardly be used as a dependent variable (Cohen 2013) as they cannot measure the phenomena robustly (Harpe 2015) and in practice should be seldom analysed individually (Norman 2010). Although, Harpe (2015) suggest that the scale should be analysed first and foremost as a group of items, results from the individual items can be visualized using a diverging stacked bar chart since individual items are treated as ordinal data.

So, in essence, individual Likert scale items should be treated as ordinal data, but when they are combined into a scale by summation or mean they can be treated as interval data. As such, the researcher utilized the following protocols in analysing the Likert scale data for this study:

1. Individual scale items were treated as ordinal data and results were presented in order to conduct preliminary analysis of scale using a diverging stacked bar chart to present the frequency of agreement and disagreement as a percentage.
2. For each scale that represents a latent variable the weighted mean was calculated using the individual items that measure the phenomena, therefore the scale was treated as interval data. So, additional statistical analysis was conducted at the scale or latent variable level not at the item level. The weighted mean was interpreted as follows: 1 - 2.33 **Low**, 2.34 - 3.66 **Moderate** and 3.67 - 5 **High.**

In addition to the treatment of the Likert scale data as described above, it was also extremely important to determine whether or not the data was normally distributed. Since, according to Norman (2010, pg. 627) parametric methods and structural equation modelling are based on normally distributed population data. The researcher utilized both the Skewness coefficient and Kurtosis to check for normality of the distribution. According to Kline (2011, pg. 63) skewness coefficient of less than 3 and kurtosis value of less than 10 can be accepted. From the results shown in the Table 4.5 below, it can be seen that the constructs showed some degree of skewness and kurtosis issues. However, they were not extreme and were within the acceptable range defined by Kline (2011) as the skewness values ranged from -0.357 to -1.260 and the Kurtosis value ranged from -

0.09 to 1.682. therefore, the normality condition for using parametric statistical analysis and structural equation modelling was satisfied.

Descriptives

	Skewness	Kurtosis
Cog_Need_Scale	-1.260	1.535
Aff_Need_Scale	-.357	-.419
Soc_Need_Scale	-.576	-.009
Sel_Eff_Scale	-.731	.682
Lrn_Rel_Scale	-.959	.923
Sub_Norm_Scale	-.386	-.326
Per_Ease_Scale	-.779	.565
Per_Useful_Scale	-.804	.524
Beh_Intention_Scale	-.643	.268
CMLP_Scale	-1.021	1.682

Table 4.5 Results of Skewness and Kurtosis

Furthermore, Kline (2011, pg.12) suggested that the typical sample size for studies based on the use Structural Equation Modelling (SEM) should be two hundred (200), this study has therefore surpassed the recommended sample size since as the sample included 345 responses. Moreover, Jackson (2003 cited in Kline 2011) support the use of the N:q rule, that is, the ratio of cases (N) to the number of model parameters (q), The N:q rule considers the model complexity in determining the minimum sample size required by using a ratio of 20:1. When applied to this research, given that there are 13 parameters, the minimum sample size would be two hundred and sixty (260). Therefore, the research satisfies the criteria of a sufficiently large enough sample size to conduct SEM.

In light of the above discussion, which demonstrated the fitness of the data for use in parametric statistical analysis and structural equation modelling. The researcher went about the analysis and presentation of results in two phases.

4.7.2 Phase 1- Descriptive and Inferential Statistical Analysis

Phase 1 of the analysis involved analysing the latent variable or scales individually using descriptive statistics and inferential parametric statistics as the criteria for using parametric analysis was met. As shown in Table 4.6 below, a range of techniques were used to derive valuable information such as mean score of scales, frequency of response set for scale items, test for independence, test for differences in mean scores, correlation between scales and regression analysis between the independent and dependent variable.

Constructs	Purpose of Analysis	Statistical Analysis Conducted
	Summary of results	Frequency % Table
	Display Frequency	Bar Charts
Demographics	Average	Mean
	Dispersion	Standard Deviation
	Most frequently occurring choice	Mode
	Difference in mean by gender	Independent samples *t* test
	Independence by age, gender, job status	Cross Tabulation Chi Squared test X^2
Motivational Factors for Mobile Learning Adoption	Presentation of individual scale item results	Frequency % Diverging Stacked Bar Chart
	Perception and Attitude towards phenomena	Mean Standard Deviation
	Difference in mean by gender	Independent samples *t* test
Pedagogical Factors for Mobile Learning Adoption	Difference in mean by age and job status	One Way ANOVA *F* test
	Location of Differences	Scheffe Post Hoc Test
	Difference in CMLP by Behavioural Intention	Cross Tabulation Chi Squared test X^2
Behavioural Intention	Strength and direction of relationship between Latent Variables and Behavioural Intention	Pearson's Correlation Coefficient, r
	Rank of latent variables	Bar Chart-Mean Scores
	Behavioural Intention Categorization	Split Procedure using mean Bar Chart- Frequency

Constructivist Mobile Learning Preference	Perception and Attitude towards phenomena	Mean Standard Deviation
	Average Perception and Attitude towards CMLP scales	Mean Standard Deviation
	Comparing the mean scores between the CMLP scales	Paired samples *t* test
	Rank of CMLP scales	Bar Chart- Mean Scores
	CMLP Categorization	Split Procedure using mean
	Display Frequency of CMLP Categorization	Bar Chart- Frequency %
	Difference in adoption intention by CMLP category	One Way ANOVA *F* test Means Plot
	Strength and direction of relationship to adoption intention	Pearson's Correlation, r Scatter Plot with fit line Coefficient of determination, R^2
	Difference in mean by gender	Independent samples *t* test
	Difference in mean by age and job status	One Way ANOVA *F* test

Table 4.6 Summary Analyses used for measurement Scales

4.7.3 Phase 2- Structural Equation Modelling

Secondly, phase 2 of the analysis involved the use of Structural Equation Modelling (SEM) in order to evaluate the effect of the independent variables on the dependent variable. The independent variables are the scales within the motivational and pedagogical factors as well as the constructivist mobile learning preference scale. In addition, the behavioural intention to adopt mobile learning was used as the dependent variable for this analysis.

In essence, SEM allowed the researcher to investigate the interrelated dependence relationships among the independent latent variables and the dependent latent variables simultaneously (Hair et al 2010). Furthermore, SEM is therefore capable of specifying these interdependent relationships through a structural model to describe the complete set of associations, where the dependent variables in one relationship can become independent variable in another relationship. This gives SEM superiority over multiple regression analysis which use separate relationships for each independent variable, as "SEM estimates a series of separate, but interdependent, multiple regression equations simultaneously" (Hair et al 2010, pg. 547).

Thus, the SEM structural model, visually depicts the paths between the exogenous latent independent variables and the endogenous latent dependent variables (Hair et al 2010), where by the regression weights (path coefficients β) for each of these parameters are estimated. This also gives SEM superiority over multiple regression analysis as the later overlook measurement error, that is, it assumes the independent variable is a reliable measure of the construct (Hair et al 2010). But SEM, estimates the true structural coefficient estimates as opposed to the observed regression coefficient by accounting for measurement error by including the reliability coefficient of the independent variable in its estimation (Hair et al 2010). Consequently, SEM overcomes the weakness of multiple regression analysis which typically understates the true regression coefficient (Hair et al 2010).

With regards to the types of SEM, there is the covariance based and component based techniques (Briz-Ponce et al 2016). This research utilized the covariance based technique and therefore used the IBM AMOS version 20 as the software tool. It is also worth noting that IBM AMOS utilizes the maximum likelihood estimation method to estimate the outputs from the path analysis. In other words, the maximum likelihood method, according to Kline (2011) derives an estimate of the regression weights that maximizes the generalization predictability of the sample to the population, another reason for using SEM over multiple regression analysis.

The 2-step process for conducting SEM was adapted from Hair et al (2010), which involves firstly, testing the construct validity and goodness of fit of the measurement model, which was done using Confirmatory Factor Analysis (CFA). Secondly, testing the structural model, which was done using Path Analysis and estimation of regression weights for each parameter, that is, hypothesis testing. Together, they provide for a complete assessment of the theoretical model.

4.7.3.1 Step 1- Measurement Model Evaluation

This was done using Confirmation Factor Analysis (CFA). Firstly, the constructs in the measurement model for this research were evaluated for reliability to determine the extent to which the selected items measure the same construct consistently on different populations (Salkind 2003). There are several types of reliability, but since the questionnaire was based on a five (5) point Likert scale of agreement, it was imperative to test for internal consistency (Sekaran, 2000). Therefore, the evaluation was done through the use of Cronbach Alpha and Composite Reliability (CR) as suggested by Hair et al. (2010).

Secondly, validity was assessed to determine the extent to which the constructs designed for the research reflected reality (Chavoshi and Hamidi 2018), that is the reasonableness of the Likert items to measure what it was intended to measure (Hair et al. 2010). Specifically, construct validity was examined through the use of both convergent validity and discriminant validity. Convergent validity determined if the degree of correlation amongst the construct items were satisfactory and discriminant validity appraised whether the correlation between the constructs were not greater than the measures for that construct itself (Sekaran, 2000).

Based on Fornell and Larcker (1981) and Hair et al (2010) criteria, factor loadings, Composite Reliability (CR) and Average Variance Extracted (AVE) was used to measure convergent validity, while discriminant validity was examined by using the square root of the AVE (Briz-Ponce et al. 2017).

Thirdly, CFA was used to evaluate the extent to which the model fit the data and to ensure that there are no discrepancies and that the data speak to the model (Kline 2011) by using Goodness of Fit Indices. Once there is acceptable fit, it means that the researcher's model has support (Hair et al 2010). Therefore, various goodness of fit indices was used to evaluate the model fit, namely absolute fit indices, approximate fit indices and incremental fit indices. The specific model test statistics that were used are shown in Table 4.7 below.

Category of Goodness of Fit Indices	**Model Test Statistics**	**Recommended Acceptable Values (Hair et al 2010)**
Absolute Fit Indices	(CMIN/ df) ratio	< 3
Approximate Fit Indices	Root Mean Squared Residual (RMR)	< 0.1
	Root Mean Square Error of Approximation (RMSEA)	< 0.08
	Goodness of Fit Index (GFI)	> 0.9
	TLI	> 0.9
	Comparative Fit Index (CFI)	> 0.9
Incremental Fit Indices	Normal Fit Index (NFI)	> 0.9

Table 4.7 Model Fit Test Statistics and Thresholds

4.7.3.2 Step 2- Structural Model

This step of the SEM analysis involved specifying the proposed model that explain the behavioural intention to adopt mobile learning by assigning dependence relationships between the various constructs (Hair et al 2010). Essentially, this process resulted in the creation of the path diagram that visually show the relationships between the exogenous and endogenous latent variables in the proposed model. By so doing, the researcher was able to develop the hypotheses of the relationships that exist among the model constructs, in other words each parameter was now specified as a hypothesis (Kline 2011).

The next process involved validating the specified model for Goodness of Fit, since estimation can only be performed when the model is deemed to be fit. Thus, in order to validate the goodness of fit, the researcher used the same model test statistics shown above in Table 4.7.

The last step in the structural model analysis required the researcher to execute the calculations of the estimates and interpret the results. The interpretation involved evaluating the standardized regression weights (path coefficient β) for each parameter, that is, for each combination of exogenous to endogenous constructs and endogenous to endogenous constructs.

In addition, Hair et al (2010) suggested that the corresponding hypotheses are tested, as the validity of the proposed model increases when the path coefficients are statistically significant and are in the direction of the proposed relationship. Furthermore, in order to estimate the total effect of each independent variable on the dependent variable, the summation of the direct and indirect effects was utilized. Therefore, the researcher derived the direct and indirect effect for each of the motivational factors, pedagogical factors as well as the constructivist mobile learning preference factor on the behavioural intention to adopt mobile learning. According to Kline (2011, pg.164) “indirect effects are estimated statistically as the product of direct effects, either standardized or unstandardized, that comprise them. They are also interpreted just as path coefficients”.

Moreover, in order to get a complete evaluation of the extent to which the motivational factors, pedagogical factors as well as the constructivist mobile learning preference factor can explain the behavioural intention of students adopt mobile learning, the researcher interpreted the variance explained estimates, that is, the squared multiple correlations (R^2).

4.8 Ethics

Turning now to the ethical issues and how they were addressed in the research. The researcher faced two (2) main ethical issues, that is, firstly, the research involved human participants and gaining access to the participants of the research and secondly, protecting the privacy of the participants and confidentiality of their data. In order to address these issues, the researcher implemented several actions to mitigate the risk which are discussed below.

The researcher obtained permission from the president of the private higher education institution to access the participants before the SL2G Project was launched and the distribution of the online questionnaire (see Appendix 3 for permission letter). The gatekeeper has granted use and ownership of the data collected, and understands that the findings will be disseminated at Anglia Ruskin University and elsewhere, including for publication and that Anglia Ruskin University is unable to completely guarantee that the organisation could not be identified by any party.

The researcher did not provide any incentive to the participants, financial or otherwise, other than an explanation of the educational benefit to the students from taking part in the research. In order to protect the participants of this study several measures were used to mitigate the risks to which they may be exposed. This included obtaining informed consent and respecting their rights in accordance to the Data Protection Act (UK) 1998 and the Data Protection Act (TT) 2011. The data collected was not processed to support decisions relating to particular individuals or to damage or distress the participants nor will their legal rights be compromised by agreeing to take part in the study.

In order to inform the participants about the SL2G project and about the purpose of the research, the researcher on his doctoral webpage explained the purpose of the research, the value of the research and the benefit of the research to the students from the onset (see http://www.samuellearning.org/dba.html). This and further explanations of the participant's rights to privacy, confidentiality, anonymity, voluntary participation and data protection among other important details were included on the Participant Information Sheet (see Appendix 5 for PIS). In order to ensure that informed consent was obtained, the PIS was presented to the participant on the welcome screen of the online questionnaire and the participants were then asked whether they agree to take part using a yes/no question. Only participants who chose yes to this consent question were able to complete the questionnaire. Additionally, the participants were informed through the PIS that their participation is voluntary and that they can withdraw from the study at any time without giving a reason and without having the data recorded, by exiting the survey webpage.

With regards to privacy and confidentiality of the research participants, the researcher did not interact with the participants directly during the data collection process, therefore the physical identity of participants was not known to the researcher. Also their identity was kept anonymous as the questionnaire was completed online by the participants and no data was collected on their personal and personal sensitive information other than what was required to aid in the data analysis. Additionally, the option to collect the participant's IP address was disabled. Additionally, a link to the online survey tool website's privacy policy (http://www.google.com/policies/privacy/) was provided on the PIS. Moreover, identification was suppressed by generalizing the findings by using statistical analysis, as such the findings was not reported as individual items. The data submitted by the participants was stored on a cloud storage service, which was secured using a password and only the researcher had access to it. The data was loaded onto a IBM SPSS and IBM AMOS in an anonymised format on the researcher's personal laptop which was secured by password. This dataset was only accessible to the researcher therefore; the data was not disclosed to the public or to any other individuals since the researcher took on the role of the data controller.

In order to reduce the researcher's influence over the students' responses, the invitation to online questionnaire was emailed from the desk of the MBA programme administrator and not directly from the researcher. Additionally, the researcher maintained a professional level of interaction and discourse about the research with the students during the period of the SL2G project. Moreover, the choice of using a questionnaire further mitigates this issue, as students were able to complete the responses voluntarily and privately without the possibility of their identity becoming known to the researcher. This would have encouraged honest and unbiased responses. In closing this section, the study was provided with ethical approval from the university's faculty research ethics panel (see Appendix 6 for approval letter).

4.9 Chapter Summary

This chapter provided a discussion of the research design and methodology used in order to achieve the research objectives and generate answers to the research question. The chapter covered the justification and choice of the research paradigm and methodology, that is, interpretivism and action research respectively and how it was applied to the research problem given the context of the research.

In addition, the researcher articulated the procedure used to collect the data required to operationalize all the research objectives. This included details of the participants, sampling, administration of the online questionnaire, instrument design and the strategies used to mitigate the ethical risk posed by the research design.

The chapter also included a meticulous description of the procedure used to analyse the data collected from the online questionnaire. In summary, the procedure involved the use of both descriptive and inferential parametric statistics, but more importantly, structural equation modelling to discern the relationships between the adoption factors and behavioural intention to adopt mobile learning. As such, the following chapter will focus on the presentation of the results, discussion and interpretations of the findings.

CHAPTER 5 ANALYSIS AND DISCUSSION OF MOBILE LEARNING ADOPTION

5.0 Introduction

The previous chapter provided insights on the robustness of the research methodology and design used to operationalise the research objectives. Therefore, the preceding chapter formed the basis for the reliability, validity and credibility of the results, analysis and discussion presented herein, from which generalizations would be made towards answering the research question. As such, this chapter focuses on the results from the online questionnaire administered after the various stages of the SL2G project that was conducted at a private higher education institution in Trinidad. The online questionnaire results were used to evaluate the motivational and pedagogical determinants of mobile learning adoption and behavioural intentions of adult learners as well as their propensity towards a constructivist learning environment.

In order to maintain coherence with the research objectives stated above and the subsequent constructs derived and presented in the conceptual framework the following themes would be developed in this chapter. Firstly, the **Demographic** profile of the participants and their mobile usage with key analysis towards educational intentions. Secondly, **Motivational Factors** for mobile learning adoption which will includes Cognitive needs, Affective needs, Social needs, Self-Efficacy and Subjective Norm. Thirdly, **Pedagogical Factors** which includes Learning Relevance, Perceived Ease of Use, and Perceived Usefulness. Fourthly, **Constructivist Mobile Learning Preferences** which includes an analysis of continuity, Timely Guidance, Inquiry Learning, self-management and adaptive content. Finally, **Behavioural Intentions** of adult learners to adopt a mobile learning environment to complement their traditional classroom environment.

Throughout these themes, preliminary analysis was conducted using diverging stacked bar charts for each of the scale items that represented the constructs measured. Additionally, descriptive statistics was also performed on the constructs as well as hypothesis testing to investigate differences in attitudes using selected demographic variables, which were generated using IBM SPSS version 26. It is important to note that all statistical test was conducted using a significance level of $p < .05$.

Furthermore, in order to test the proposed model for mobile learning adoption, Structural Equation Modelling (SEM) was conducted, which combined both confirmatory and exploratory factors analysis and path coefficient analysis. This was completed by using IBM AMOS version 20.

5.1 Demographic Profile of Participants

This section will provide valuable insights into the demographic profile of the participants of study. This is important in order to understand the nature and characteristics of the sample population, thereby justifying the generalizations for the population of higher education students (Salkind 2010). Additionally, demographic variables can be used to make further inferences about the main constructs by using appropriate statistical test, which will be conducted in the later sections of the chapter. The results obtained from the demographic variables are shown in Table 5.1 below. The descriptive statistics for the demographic variables were processed using IBM SPSS 26, the raw outputs from SPSS can be found in Appendix 1. The graphical representations were produced in MS Excel 2016 using the results extracted from SPSS 26.

The gender distribution of the sample was adequately balanced, since 42.3% were male and 57.7% were female. This result is similar to the student population of the University of Trinidad and Tobago (UTT), whose student survey for the academic period 2015-2016 showed their sample population being 49% male and 51% female (UTT 2016, pg.5). However, the University of the West Indies (UWI) student population digest for 2017-2018 reported a marginally higher proportion of female students (63%) attending their campus (UWI 2018, pg.17).

Variable	Categories	Result
Gender	Male	42.3%
	Female	57.7%
Age (years)	20-24 years	7.5%
	25-34 years	37.4%
	35-44 years	38.0%
	45-54 years	14.8%
	55+	2.3%
	Mean Age	36
Job Status	Full Time Employment	85.2%
	Part Time Employment	2.9%
	Self-Employed	6.4%
	Unemployed	5.5%
Work Life Studying Hours	Job/Work	>7 hrs- 79.4%
	School/Studying	1-4hrs- 82.1%
	Family	1-4hrs- 73.4%
	Socializing	1-4hrs- 69%

Table 5.1 Demographic Profile of Participants (N=345)

Overall, there is consistency with regards to a higher proportion of female students, which is consistent with the MSTTE (2010a) baseline sectoral analysis which reported a female population of 64% in the academic year 2009-2010. As such the result suggests that the sample drawn for this study is sufficiently similar in terms of gender to that of other higher education institutions.

With respect to age, given that the research was conducted using only adult learners enrolled in an MBA programme at a private higher education institute, all the respondents were between the ages of 21 and 60 years old with a reported mean age of 36 ($M = 36.14$). The majority of students fell in the categories 25-34 years (37.4%) and 35-44 years (38%). This is consistent with the UWI (2018, pg. 17) as they reported that the "majority of the postgraduate population between the ages of 25 and 34 years old". Similarly, MSTTE (2010a) conveyed that 53% of the students in the sector fell in the age category 20-29 years. So overall, the majority of students are in the cluster 20-44 years, for this survey that accounts for 82.9% of the sample. Therefore, the age distribution of respondents for this study appears to be representative of the higher education student population in Trinidad and Tobago.

Even more interestingly, it was revealed that female students led in the age groups 21-24, 25-34 and 35-44 as seen in Table 5.2 below. Conversely, male students dominated the category 45-54, with a balance in the 55+ category. In other words, the sample is comprised of mainly young adults who are predominantly female, which is consistent with the findings of the MSTTE (2010a, pg. 28) who stated "students within the post-secondary and tertiary education sectors are principally young and female".

			Age_Group					
			21-24	25-34	35-44	45-54	55+	Total
Gender	Male	Count	10	51	49	32	4	146
		% within Age_Group	38.5%	39.5%	37.4%	62.7%	50.0%	42.3%
	Female	Count	16	78	82	19	4	199
		% within Age_Group	61.5%	60.5%	62.6%	37.3%	50.0%	57.7%
Total		Count	26	129	131	51	8	345
		% within Age_Group	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Gender * Age_Group Crosstabulation

Table 5.2 Cross Tabulation for Gender and Age Group

Another important characteristic of the student population is that of working while studying, since spending time at work can interrupt learning as longer hours of work translates into less time for learning activities (Creed et 2015; Curtis and Shani 2002), even more so when students are working full time (Darolia 2014). Mobile learning ubiquitous nature can facilitate the bridging of the formal and informal learning space by offering students flexibility and facilitating seamless learning (Kukulska-Hulme and Traxler 2013; Looi et al 2010). The results showed that 94.5% of the students are employed, of which 85.2% are working full time (see Table 5.1 above). Furthermore, 79.4% of the respondents indicated that they worked an average of at least seven (7) hours per day. Additionally, with regards to family and socializing activities, the results showed that 73.4% and 69% respectively, spent an average of one (1) to four (4) hours daily and for the same timeframe 82.1% indicated they engage with learning activities (see Table 5.1 above).

Chi-Square Tests				
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	26.461[a]	15	.033	.066
Likelihood Ratio	21.271	15	.128	.075
Fisher's Exact Test	21.670			.064
N of Valid Cases	345			

a. 16 cells (66.7%) have expected count less than 5. The minimum expected count is .14.

Table 5.3 Fisher's Exact Test- Job Status*Hours spent Studying

Further analysis using Fisher's Exact test for independence between study time and job status reveals that there was no significant association, since p > .05 (see Table 5.3 above). Therefore, in this study, time spent on learning activities is independent of the students' job status. This is an interesting finding as it contradicts the findings of many researchers (Manthei and Gilmore 2005; Creed et 2015; Curtis and Shani 2002;) but can be explained given that 94.5% of the respondents were employed.

In summary, the findings suggest that the majority students spend 1 to 4 hours daily on learning activities regardless of their employment status while enrolled in a course. Additionally, taking into consideration the results shown in Figure 5.1 below, students most frequently used their mobile device either at home (47.2%) or at work (39.7%) and students spend an average of 6 hours (M = 5.8 hours) on their mobile device daily (see Appendix 1 for statistic). Furthermore, an independent sample t-test was performed to test for any differences between male (M = 5.71 hours) and female (M = 5.86 hours) students regarding the mean time spent on their mobile device. The t-test (t (343) = - 0.35, p = .58) revealed that there is no statistical difference in the amount of time students spent on their mobile device by male and female students.

The opportunity to extend the learning process outside the classroom through the use of mobile learning activities to further engage the students and provide flexibility, becomes even more evident in terms of balancing students' work-life-study given the context of learning in the private higher education in Trinidad.

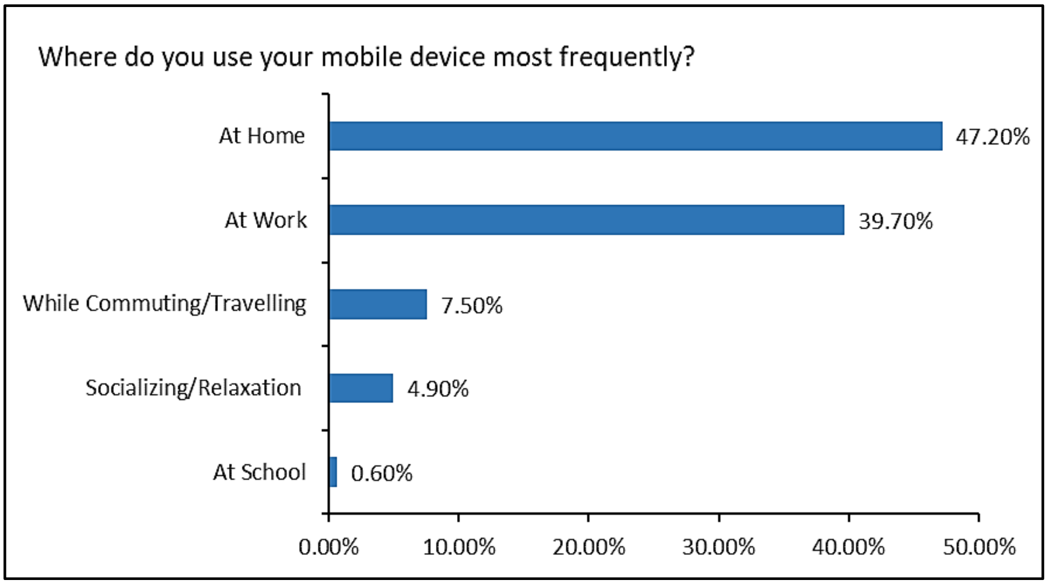

Figure 5.1 Place of Most Frequent Mobile Device Use

5.2 Mobile Learning Profile of Participants

This section turns to mobile device ownership and usage by students for both personal life and in relation to learning activities. The intent of this section is to shed light on the current usage of mobile technology for every day, personal activities and the extent to which students are already engaging with informal educational activities on their own.

Results have shown, that 98% of the students own a laptop, similarly 97% own a smartphone, while 73% have a tablet and 30% own other mobile devices (see Figure 5.2 below).

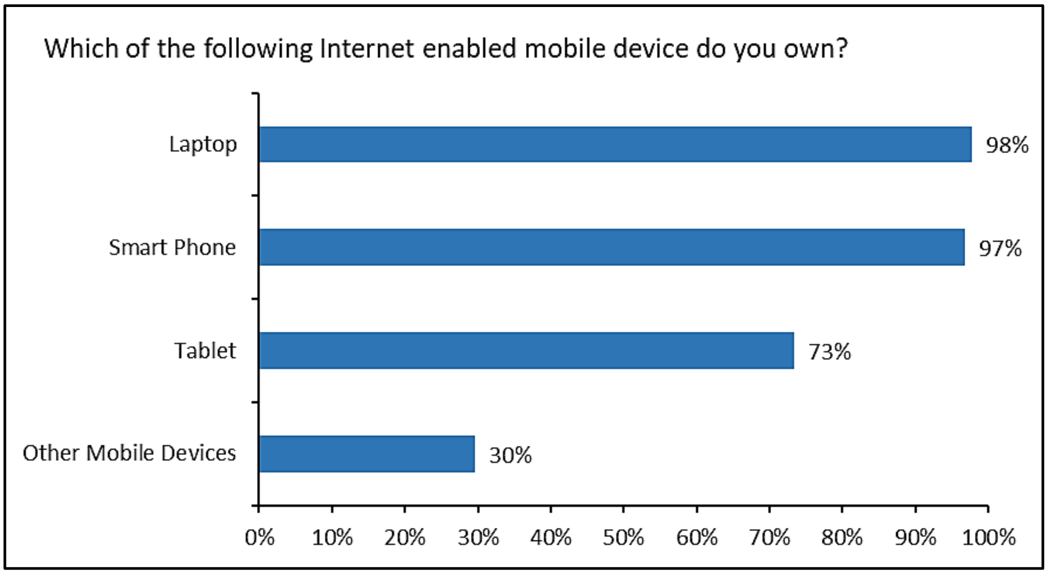

Figure 5.2 Mobile Device Ownership

This reveals that owning a mobile device is now common among students in higher education and is consistent with a recent Deloitte's 2019 mobile consumer survey which found that "smartphones are now the world's most ubiquitous digital device" with around 90% of adults owning a smartphone (Lee et al 2019). It is also important to note, that all respondents owned at least one mobile device, in fact, 97% owned two or more devices (see Appendix 1 for frequency table) which is expected given that the mobile penetration rate in Trinidad and Tobago as reported by TATT (2018, pg. 47) currently stands at 145.1 per 100 inhabitants. Additionally, the findings with regards to mobile device ownership were consistent with previous studies such Al-Emran et al (2016) and Briz-Ponce et al (2016).

5.2.1 Personal Life Usage

In light of the above, it is without contradiction that smartphones have become an integral part of everyday life. This is evident by Statista's recent publication of number of smartphone users worldwide from 2016 to 2021, which forecast the number of global users to be 3.8 billion by 2021 (Holst 2019). The participants of the study were asked "would you say that a mobile device is a central part of everyday life?", results revealed that 86% agreed to this statement (see Appendix 1 for frequency table).

In terms of personal usage, the study found, as shown in Figure 5.3 below, that the top five activities undertaken on a daily basis on their mobile devices included messaging (98%), accessing emails (97%) and browsing the web searching for information (94%), reading (82%) and social media (75%). This finding is comparable to those of Al-Emran et al (2016, pg. 97) and Tosell et al (2015, pg. 717) who both concluded that messaging and communication applications are the most used on smartphones among students. Surprisingly, playing games (32%) was not as popular as listening to music (66%) among students, which is similar to a study done by Nayak (2018, pg.168) among 429 higher education study in India, 35% and 63% respectively.

Additionally, in terms of gender, popularity of mobile device activities was not found to be significantly different between male and female students with the exception of social media usage (X^2 [1, n=345] = 4.7, p = .03) and taking photos/videos (X^2 [1, n=345] = 9.8, p = .002).

With respect to age, it was found that of the activities included in the study, there was a significant association with only social media usage (X^2 [1, n=345] = 10.3, p = .036), while for the other activities there was no significant difference by age as in all cases p > .05.

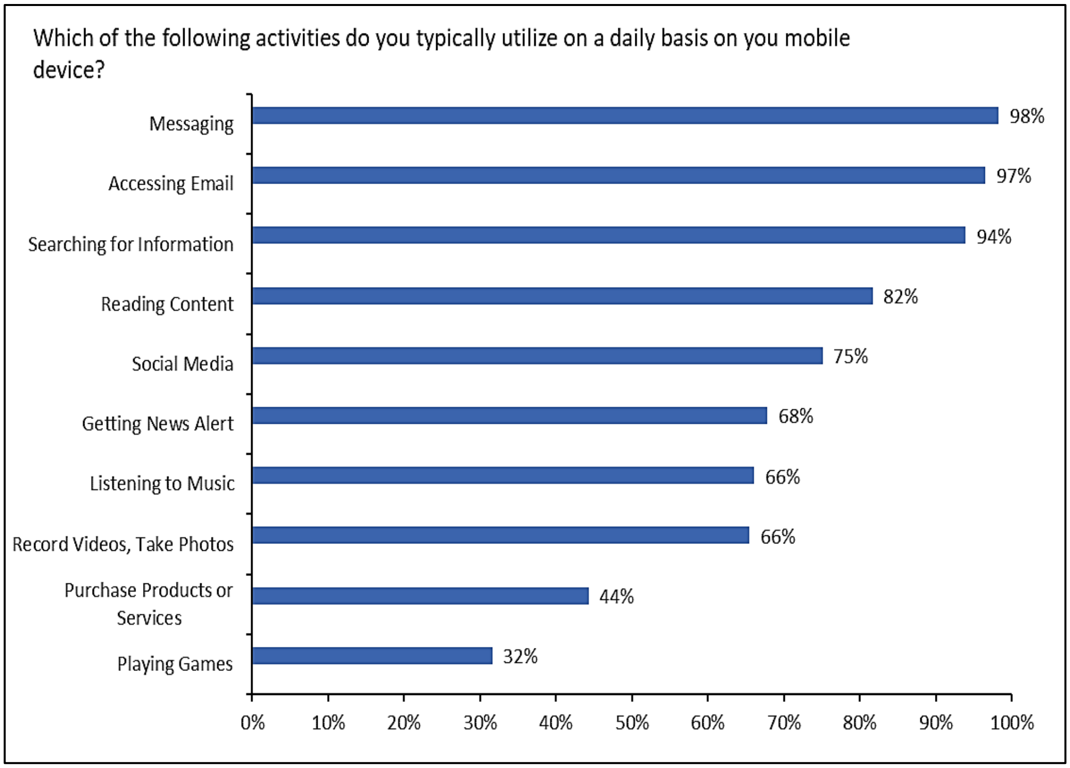

Figure 5.3 Mobile Usage for Personal Activities

Further exploration of using mobile device for personal activities was done by looking for an association to job status. The results of the Chi-Square test revealed that only accessing email (X^2 [1, n=345] =9.6, p = .026) was found to be significantly associated, while the other activities were not significantly different by students' job status.

Overall, from the above analysis for difference in usage of a mobile device for personal activities by students' characteristics, only sporadic differences were found as the majority of activities undertaken by students were similar regardless of their gender, age and job status.

5.2.2 Educational Usage

Another significant aspect of the study involved investigating the extent to which students are already using their mobile device for educational activities inside and outside the classroom. In terms of course material, as shown in Figure 5.4 below, searching for terms used by the lecturer was the most popular (79%), followed by downloading lecture notes (76%), reading articles about a topic (72%), scheduling important deadlines (68%), accessing the University VLE (63%), taking photos of lecturer's notes (55%) and video/audio record the lecturer's guidelines for assignments (42%). Several studies have also confirmed similar behaviour of students when using their mobile device for educational activities. For instance, Anshari et al (2017) found that smartphone improved learning experience in the classroom as students were able to download digital course material and find information on the spot. The same study goes on to opine that smartphones are good educational aids as they afford the students the convenience of taking photos of the lecturer notes. Similarly, Karatas (2018, pg.607) found that students used their devices "for searching the subject or the term of the course, academic research, following course materials, taking notes via photographs".

In terms of activities related to communication and messaging, this study found that 73% of the respondents said they message fellow students. However, only 38% took part in class forums and blogs, suggesting that forums and blogs are not as popular as contemporary messaging services such as WhatsApp, which is confirmed by Statista's market data on Internet and Mobile Apps 2019 report, stating "it is one of the most popular mobile social apps worldwide" (Clement 2019).

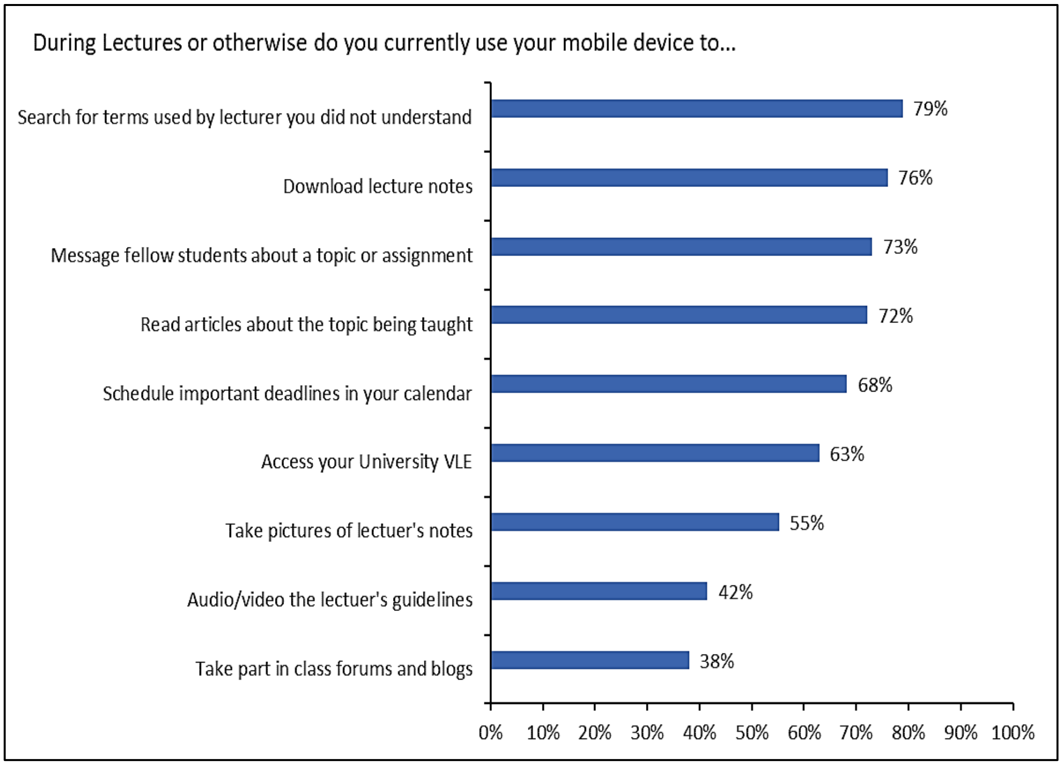

Figure 5.4 Mobile Usage for Educational Activities

Moreover, this finding is supported by Nayak (2018, pg. 171) who found that 74% of students use their smartphones for messaging including using WhatsApp. Similarly, Tossell et al (2015, pg.717) and Anshari et al (2017, pg. 3071) found that the most popular apps compared to other apps is substantially instant messaging apps and Short Messaging Service (SMS). With respect to gender differences, use of mobile device for educational activities was found to be significantly different between male and female students with the exception of messaging fellow students (X^2 [1, n=345] = 7.2, p = .007). Therefore, as seen in the cross-tabulation in Table 5.4 below, the frequencies are significantly different, as among those who use messaging, 37.8% were male and 62.2% were female students.

Gender * Message fellow students about a topic or assignment Crosstabulation					
			Message fellow students about a topic or assignment		
			No	Yes	Total
Gender	Male	Count	53	93	146
		% within Message fellow students about a topic or assignment	53.5%	37.8%	42.3%
	Female	Count	46	153	199
		% within Message fellow students about a topic or assignment	46.5%	62.2%	57.7%
Total		Count	99	246	345
		% within Message fellow students about a topic or assignment	100.0%	100.0%	100.0%

Table 5.4 Cross-tabulation Messaging by Gender

Furthermore, a look at differences by age found that for all educational activities, there was no significant difference in usage. This was confirmed by the Chi-Squared test, for all cases X^2 [4, n=345], p > .05 (see Table 5.5 below).

Educational Activities	**X^2 [4, n=345] Value**	**Asymptotic Significance (2-sided)**
Age_Group * Search for terms used by lecturer you did not understand	2.36	.671
Age_Group * Take pictures of lecturer's notes	4.73	.316
Age_Group * Audio/video the lecturer's guidelines	6.05	.196
Age_Group * Read articles about the topic being taught	2.86	.582
Age_Group * Message fellow students about a topic or assignment	2.27	.686
Age_Group * Access your University VLE	1.96	.742
Age_Group * Download lecture notes	3.31	.508
Age_Group * Take part in class forums and blogs	3.38	.497
Age_Group * Schedule important deadlines in your calendar	2.03	.730

Table 5.5 Chi-Squared Test Results for Educational Activities by Age

In addition, looking at the use of mobile devices for educational activities by job status, there was no significant difference in usage as evident by X^2 [3, n=345], p > .05 (see Table 5.6 below).

Educational Activity	X^2 [3, n=345] Value	Asymptotic Significance (2-sided)
Job Status * Search for terms used by lecturer you did not understand	6.01	.108
Job Status * Take pictures of lecturer's notes	5.04	.169
Job Status * audio/video the lecturer's guidelines	0.39	.942
Job Status * Read articles about the topic being taught	0.17	.982
Job Status * Message fellow students about a topic or assignment	7.01	.069
Job Status * Access your University VLE	1.01	.783
Job Status * Download lecture notes	1.01	.786
Job Status * Take part in class forums and blogs	2.32	.508
Job Status * Schedule important deadlines in your calendar	3.31	.346

Table 5.6 Chi-Squared Test Results for Educational Activities by Job Status

In general, findings regarding differences for using of mobile device for educational activities by student characteristics, found only one significant difference, that is, the use of messaging applications by gender. In other words, it can be inferred that largely speaking, students' intention to use their mobile device for educational activities does not differ by gender, age or job status.

In closing this section, the findings with regards to using mobile devices for personal and more importantly educational and learning purposes have shed light on usage of mobile devices for intentional formal learning. These findings are important, firstly it allows educators to determine whether or not mobile learning can be integrated into the pedagogical approach both inside and outside the classroom. Secondly, it will inform the design of a mobile learning environment for formal intentional learning as key features and functionality of such an environment have been identified.

The findings clearly confirm the notion that mobile devices can be used to engage in tasks related and supplemental to the students learning process, a view which is held by Tossell et al (2015, pg. 721). This is evident as the majority of students spend an average of 6 hours on their mobile device and typically spend 1 to 4 hours engaging in learning activities. Additionally, it was found that the reality is many students already use their mobile device to access and download lecturers' notes, search for and read articles, access the university VLE and message fellow students. Furthermore, the findings also confirm that there is no difference in the behaviour of students towards mobile learning activities by age, gender and job status. This augurs well for the development of a mobile learning environment since the design can be standardized, simple and intuitive and targeted to a widespread array of students (Elias 2011). This is especially critical since mobile learning promises "access educational tools and material that enlarges access to education for all" (Traxler and Kukulska-Hulme, 2005b, pg.1).

5.3 Motivational Factors for Adoption

Turning now to the key constructs of the research, this section explores the findings with regards to the motivational factors for adoption, which were based on Uses Gratification Theory (UGT) and Technology Adoption Model (TAM). Namely, the constructs included Cognitive, Social and Affective needs, Mobile Learning Self-Efficacy and Subjective Norm. In effect, this section serves to present and results and discussion of the findings relevant to research objective 1; to evaluate the motivational factors that influence behavioural intention of adult learners to use mobile learning.

This section made use of descriptive statistics for the construct's scale and its items. Each scale item was analysed as ordinal data, therefore, the results were presented using diverging stacked bar charts with discussion of the level of agreement and disagreement from respondents. Additionally, for each construct a scale was derived using the weighted mean of the scale items. The mean of the construct was interpreted as follows: 1 - 2.33 **Low**, 2.34 - 3.66 **Moderate** and 3.67 - 5 **High**. Further analysis on these scales were done to examine if there is any significant difference among students' motivational needs with regards to gender, age groups and job status. This was done using an independent samples *t*-test and Analysis of Variance (ANOVA) test accordingly.

5.3.1 Cognitive Need

Cognitive needs should motivate students to seek information and learning materials to become more engage in the learning process and construction of knowledge (Joo and Sang 2013; Thongsri et al 2018). Furthermore, Mondi et al (2008, pg.243) opined that the cognitive needs of students should motivate them to use mobile technologies for knowledge acquisition in order to be creative and critical thinkers. In other words, the mobile learning environment should be able to influence students to fulfil their need for knowledge (Hashim et al 2014, pg. 4). Moreover, students should be motivated to apply the knowledge constructed from the course to practice in the workplace and everyday life, therefore further fulfilling their cognitive needs.

The results showed that students have a **high** predisposition towards satisfying their cognitive needs through the use of mobile learning as the mean score was found to be 4.08 ± 0.95 (M = 4.08, SD = 0.98) indicating a narrow dispersion around the mean (see appendix 1 for statistics). This high rating can be explained by taking a closer look at the individual cognitive needs items. It can be seen in Figure 5.5 below that more than 85% of the respondents agreed that they will use their mobile device to search for information and over three quarters (78%) agreed that they will access learning material anywhere, anytime. Additionally, just over 60% of those surveyed suggest that they will use their mobile device to answer questions coming from class discussions. In all items, the total level of disagreement and neutral ranged from 13% to 39%.

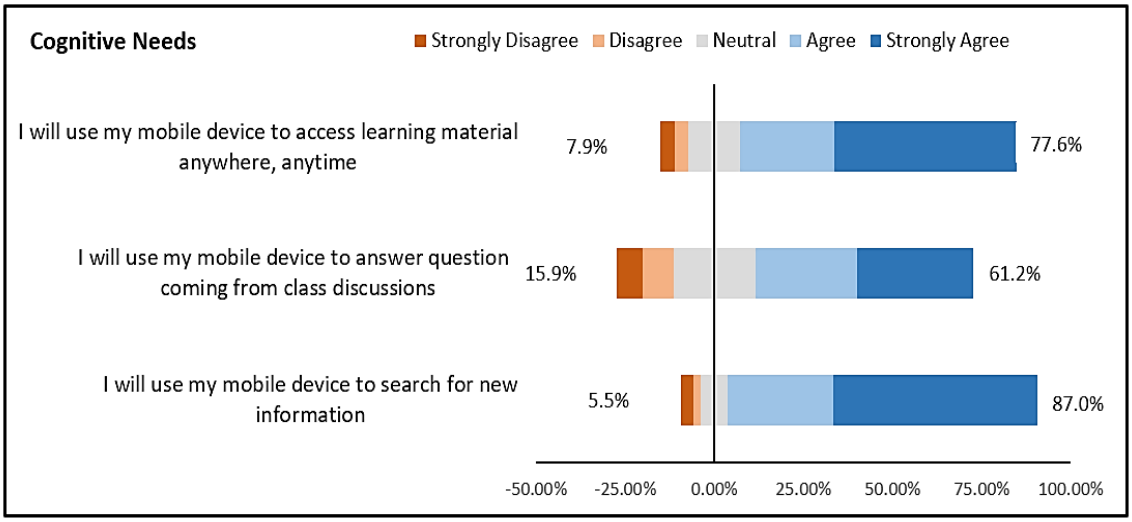

Figure 5.5 Attitude towards Cognitive Needs

5.3.2 Affective Need

Affective needs are concerned with the mood, emotional feelings and attitudes of learners' (Oliver 2009; Baydas and Yilmaz 2018). According to Reychav and Wu (2014, pg. 46) "people use media to satisfy their emotional needs". In other words, emotion is a key driver of either enhancing or inhibiting learning (Greenleaf 2003). Therefore, the affective need, as descried by Baydas and Yilmaz (2018, pg. 140) "are about students' pursuit of emotional fulfilment, pleasant feelings and aesthetic experience". Essentially, the affective need speaks to the learners' emotional need to use mediating tools during the learning process for attainment of personal fulfilment. In the context of mobile learning, the affective need will drive students to seek emotional fulfilment through the of use mobile technologies in the process of constructing knowledge (Mondi et al 2008, pg. 243). That is to say, the mobile learning environment "should be able to capture the feeling of personal fulfilment using the medium during the learning process" (Hashim et al 2014, pg.4).

The results revealed that students' propensity to satisfy their affective need through mobile learning is **moderate** as the mean score was found to be 3.54 ± 0.92 (M = 3.55, SD = 0.92). Interestingly, only 33% agreed that they like showing their friends how to use mobile devices (see Figure 5.6 below), which suggest that there is little emotional fulfilment attained from doing so. Conversely, 66% of those survey agreed that they will enjoy learning using a mobile device and a similar amount (65%) want to be innovative users of mobile applications for learning to achieve personal fulfilment.

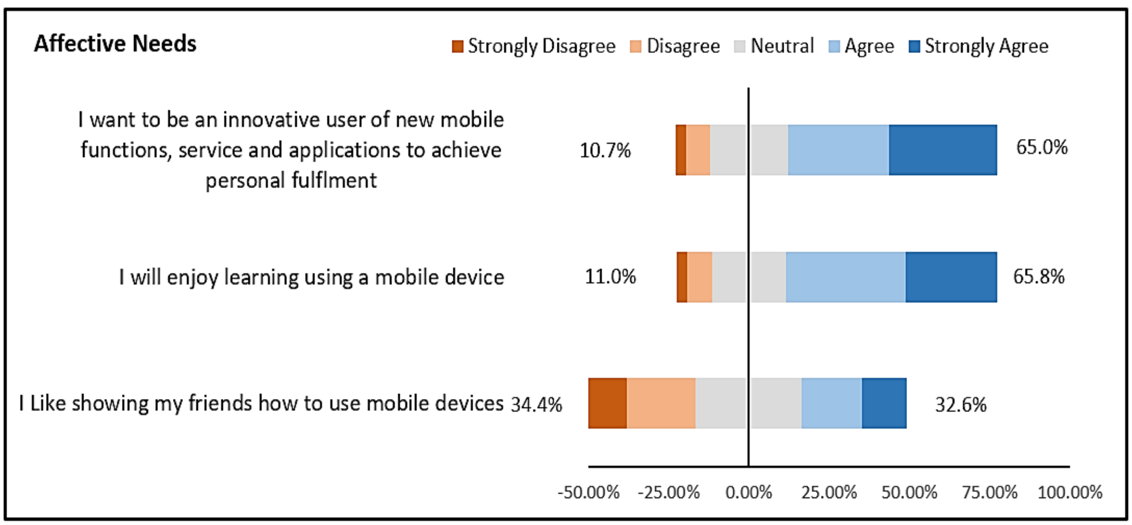

Figure 5.6 Attitude towards Affective Needs

5.3.3 Social Need

Social needs refer to the need "to socialize with others, including family, friends and relatives in society" (Reychav and Wu 2014, pg. 47). With regards to learning, it refers to the need for interaction and collaboration within the learning community (Baydas and

Yilmaz 2018), whereby gratification is received from the need to connect with others (Chen 2011). In the context of mobile learning, learners' gratification will be derived from social interaction in the learning community through the use of mobile technologies.

Therefore, the mobile learning environment should be capable of motivating learners to interact with each other, essentially fostering collaborative learning (Hashim et al 2014; Thongsri et al 2018). Furthermore, this view is supported by Mondi et al (2008) who argued that for students to create consensual meaning of the learning materials and construct meaning, they will seek social collaboration through mobile technologies.

The analysis revealed a **marginally high** level of intention to use mobile learning to satisfy social needs as the mean score was found to be 3.74 ± 0.95 (M = 3.74, SD = 0.95). From the chart below in Figure 5.7, it can be seen that three quarters (75%) of the students agreed that they will use their mobile device to interact with other students, but the depth of interaction propensity was surprisingly low.

For instance, when asked will you be more likely to ask others for help or to explain a topic by using my mobile device, just about half (55%) agreed, while 62% agreed that they will join discussion forums outside the classroom.

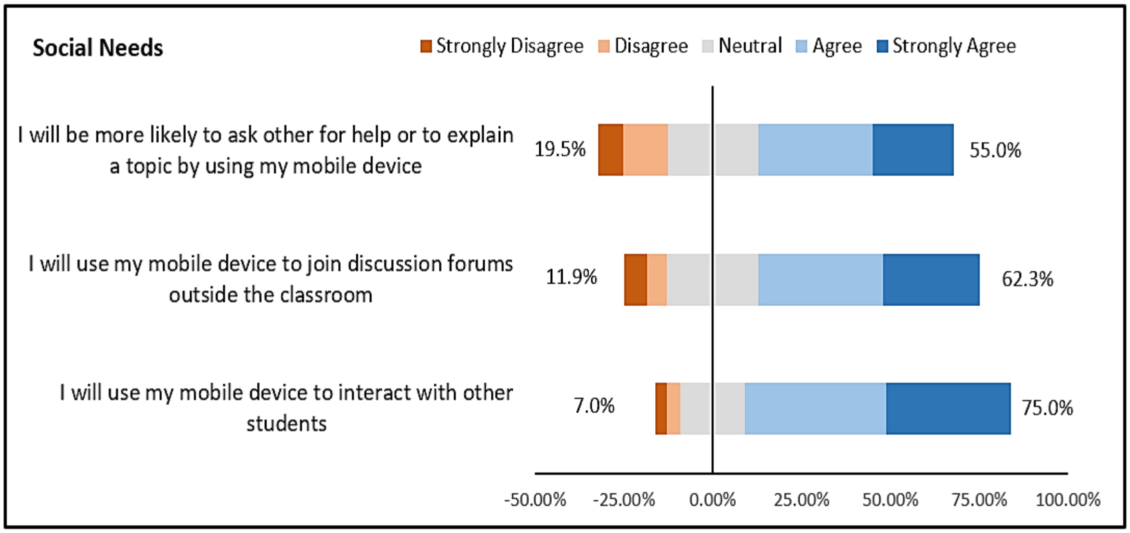

Figure 5.7 Attitude towards Social Needs

5.3.4 Self Efficacy

Self-efficacy is "judgement of one's ability to use a technology" (Venkatesh et al 2003, pg. 432). From the context of mobile learning, it refers to the learner's judgement of how well they can use the mobile learning application to enhance their learning outcome. According to Davis (1989, pg. 321) "self-efficacy beliefs are theorized to function as proximal determinants of behavior". Therefore, self-efficacy is an important element of motivation, as the learner's intention to adopt mobile learning will be influenced by their perceived ability to use mobile technology. In other words, student's acceptance of mobile learning will be commensurate with their ability to use the mobile learning environment (Chavoshi and Hamidi 2018).

The findings suggest that students have a **high** perception of mobile learning self-efficacy since the mean score is 3.91 ± 0.87 (M = 3.91, SD = 0.87). This is evident by looking closer at the individual items. For instance, as seen in Figure 5.8 below, 3 of 4 students agreed that they feel confident in performing basic functions of mobile learning and roughly 70% of students feel confident about their knowledge and skill for using mobile learning. In addition, approximately two thirds of the students agreed that they feel confident in knowing how a mobile learning system works.

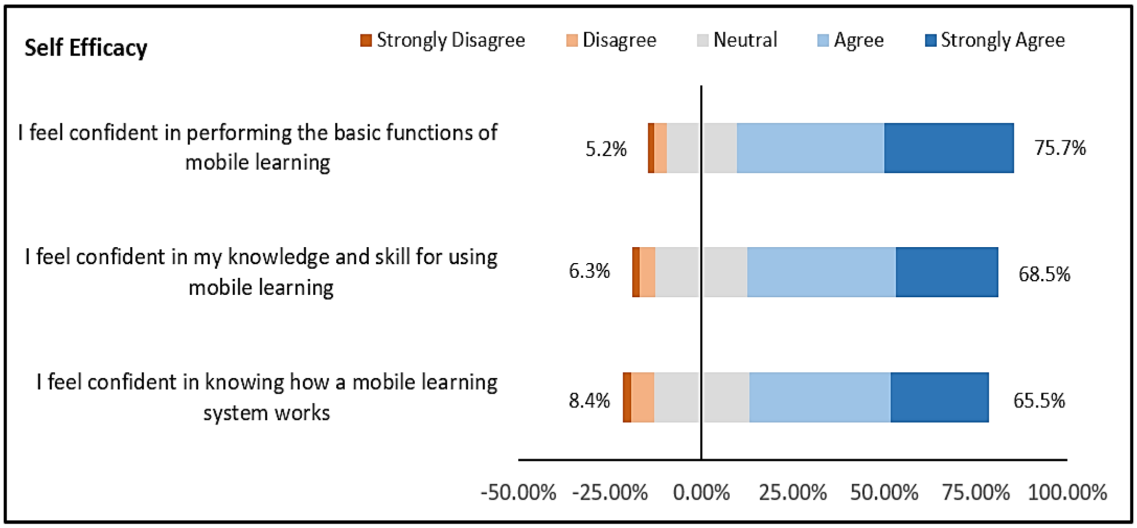

Figure 5.8 Self-Efficacy

5.3.5 Subjective Norm

Turning now to subjective norm, which taps into the social influences on students (Venkatesh and Davis 2000), that is, the student's perception of what others think will impact their intentions to adopt. This is based on the definition by Fishbein and Ajzen (1975, p. 302) that a "person's perception that most people who are important to him think he should or should not perform the behavior in question". Put another way, students may be influenced to use mobile learning even though they themselves are not inclined to do so, but because an important social influencer believe they should, they very well may (Venkatesh and Davis 2000). These social influencers include persons close to the students such as family, friends and fellow students. Taken from an academic context, in terms of mobile learning, influencers will include lecturers, administrators and other academics in authority (Hao et al 2016). Of these academic influencers, according to

Chavoshi and Hamidi (2018, pg. 143) “one of the most important people for the student is the lecturer of his/her courses”.

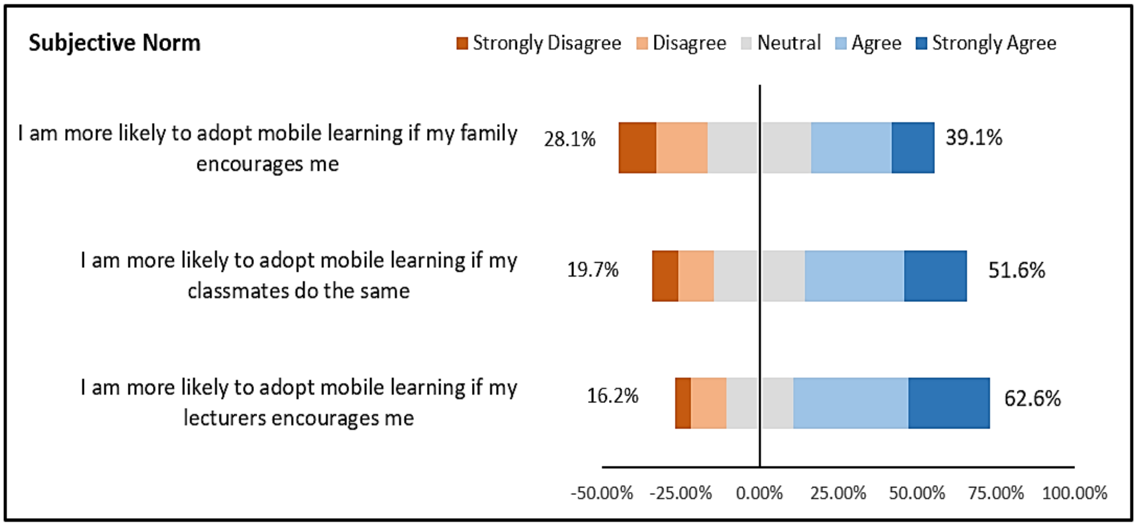

Figure 5.9 Subjective Norm

The findings from this study are consistent with the pronouncement of Chavoshi and Hamidi (2018) as students agreed that the most influential person was lecturers (63%), followed by classmates (52%) and family (39%) as seen in Figure 5.9 above. Overall, it was found that subjective norm has **moderate** influence on student’s intention to adopt mobile learning as the mean score for the scale is 3.41 ± 1.04 (M = 3.41, SD = 1.04).

5.3.6 Summary of Motivational Factors

In this section a summary of the descriptive statistics for the motivational factors will be provided. Figure 5.10 below depicts in descending order the motivational constructs using the mean score. It is important to note that all the motivational adoption factors are above the theoretical mean of 3 on the scale, ranging from moderate (M = 3.41) to high (M = 4.08). The comparison of mean scores, can give insights into the rank order of the strength of the individual motivational factors. Thus, based on mean score only, the findings reveal that the strongest motivational influence for adoption would be cognitive need followed by mobile learning self-efficacy, social need, affective need and the least influential subjective norm.

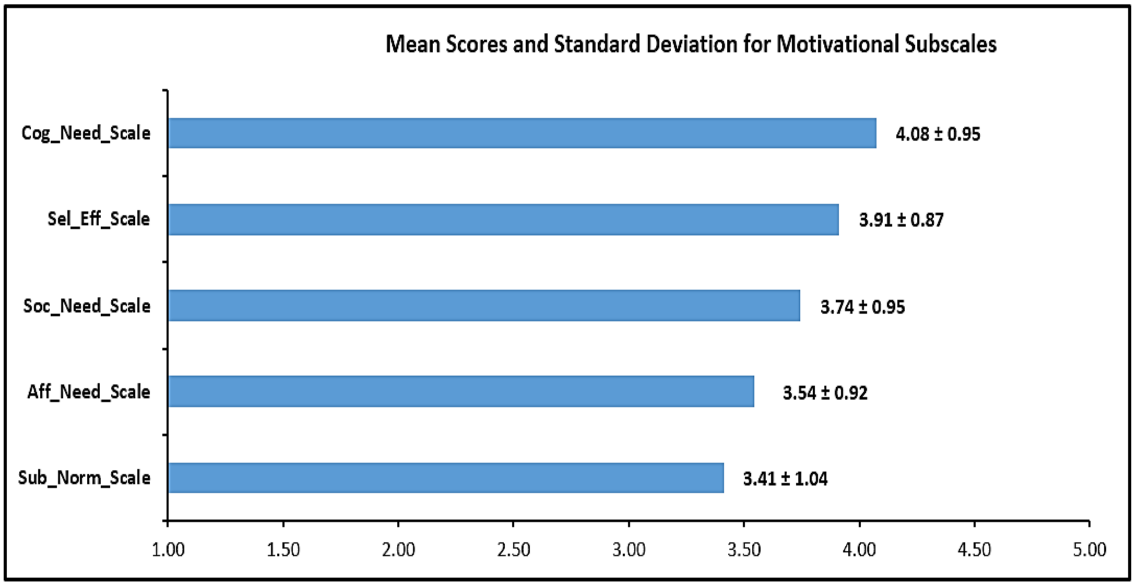

Figure 5.10 Summary of Motivational Adoption Factors

When considering the strength of the relationship between the individual motivational factors and students' behavioural intention to adopt, the correlation matrix in Table 5.7 below shows that affective need ($r = 0.570$, $p < .01$) is likely to be the best predictor of behavioural intention all be it moderately positive in strength.

Additionally, the relationships among the motivational factors for adoption was found to be low to moderate, ranging from $r = 0.191$ to $r = 0.513$. So, given that the correlations between the motivational factors are not very strong ($r > 0.9$) as defined by Field (2009), there is no multicollinearity despite the significance of these correlations at the .01 level. This suggest that the individual motivational factors of cognitive need, affective need, social need, mobile self-efficacy and subjective norm as predictors of intentions to adopt mobile learning are indeed measuring different attitudes.

		Beh_Intention _Scale	Cog_Need _Scale	Aff_Need _Scale	Soc_Need _Scale	Sel_Eff _Scale	Sub_Norm _Scale
Correlations							
Beh_Intention_Scale	Pearson Correlation	1	.436**	.570**	.405**	.420**	.477**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	345	345	345	345	345	345
Cog_Need_Scale	Pearson Correlation	.436**	1	.512**	.502**	.464**	.278**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	345	345	345	345	345	345
Aff_Need_Scale	Pearson Correlation	.570**	.512**	1	.513**	.482**	.428**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	345	345	345	345	345	345
Soc_Need_Scale	Pearson Correlation	.405**	.502**	.513**	1	.389**	.406**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	345	345	345	345	345	345
Sel_Eff_Scale	Pearson Correlation	.420**	.464**	.482**	.389**	1	.191**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	345	345	345	345	345	345
Sub_Norm_Scale	Pearson Correlation	.477**	.278**	.428**	.406**	.191**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	345	345	345	345	345	345

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.7 Correlation Matrix for Motivational Factors of Adoption

5.3.7 Gender Differences in Motivational Factors

In order to investigate if there is any statistically significant difference among the students' attitude towards the various motivational factors for adoption in terms of gender, multiple independent samples *t*-tests were conducted. From the results as seen in Table 5.8 (see test results from SPSS in Appendix 1), there is no statistically significant difference in the mean scores of male and female students across all the motivational factors, since the significance value (p) is greater than .05 ($p > .05$) in all cases.

	Mean		Standard Deviation		Result	
	Male	Female	Male	Female	*t* value	Sig (p)
Cognitive Need	3.993	4.137	1.050	0.867	-1.397	**0.163**
Affective Need	3.559	3.534	0.972	0.881	0.249	**0.803**
Social Need	3.655	3.809	0.988	0.910	-1.495	**0.136**
Mobile Learning Self Efficacy	3.874	3.939	0.931	0.816	-0.678	**0.499**
Subjective Norm	3.480	3.364	1.024	1.046	1.027	**0.305**

Table 5.8 Independent Samples *t*-test for Gender Differences in Motivational Adoption Factors

5.3.8 Age Differences in Motivational Factors

Turing now to determining if there is any significant difference in the motivational factors with respect to age. Firstly, the mean score for each motivational adoption factor is broken down by age groups as shown in Table 5.9 below.

Mean for Motivational Factors by Age Group

Mean

Age_Group	Cog_Need_Scale	Aff_Need_Scale	Soc_Need_Scale	Sel_Eff_Scale	Sub_Norm_Scale
21-24	4.0641	3.5385	3.8205	3.9744	3.2308
25-34	4.1370	3.5607	3.7649	3.9974	3.3023
35-44	4.0865	3.5725	3.7608	3.9415	3.4656
45-54	4.0327	3.4183	3.6340	3.7255	3.5425
55+	3.2500	3.6667	3.5833	3.0417	4.0833
Total	4.0763	3.5449	3.7440	3.9121	3.4126

Table 5.9 Mean Score for Motivational Factors of Adoption by Age Groups

It can be seen that there appears to be some difference in the mean values for cognitive need, and mobile learning self-efficacy, for the age group 55+, in that the mean value is lower than the other age groups M = 3.25 and M = 3.04 respectively. However, for the subjective norm, the 55+ age group the mean value (*M* = 4.08) is higher than the other age groups.

In order to confirm if there are any statistically significant differences, a One Way ANOVA was conducted as shown in Table 5.10 below. From the results, only mobile learning self-efficacy was found to be statistically significant (p = .017), that is to say, that there is a difference among the various age groups with regards to self-efficacy. Further insights into the differences in terms of age group was checked using the Scheffe post hoc criterion for significance. The results revealed that there is marginal significance difference (p = .054) between age group 55+ (*M* = 3.04) and 25-34 (*M* =4.0), see Appendix 1 for Scheffe Post Hoc Test results.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Cog_Need_Scale	Between Groups	6.051	4	1.513	1.694	.151
	Within Groups	303.605	340	.893		
	Total	309.657	344			
Aff_Need_Scale	Between Groups	1.069	4	.267	.314	.869
	Within Groups	289.595	340	.852		
	Total	290.665	344			
Soc_Need_Scale	Between Groups	1.069	4	.267	.297	.880
	Within Groups	306.425	340	.901		
	Total	307.494	344			
Sel_Eff_Scale	Between Groups	8.990	4	2.248	3.070	.017
	Within Groups	248.899	340	.732		
	Total	257.889	344			
Sub_Norm_Scale	Between Groups	7.256	4	1.814	1.702	.149
	Within Groups	362.356	340	1.066		
	Total	369.612	344			

Table 5.10 One Way ANOVA for Motivational Factors of Adoption by Age Groups

5.3.9 Job Status Differences in Motivational Factors

Similarly, in terms of differences in attitude towards the motivational adoption factors with respect to job status, Table 5.11 below that the mean scores were relatively high, with the exception of part time and unemployed students in terms of affective need.

Case Summaries

Mean

Job Status	Cog_Need _Scale	Aff_Need _Scale	Soc_Need _Scale	Sel_Eff _Scale	Sub_Norm _Scale
Full Time Employment	4.0646	3.5351	3.7109	3.8753	3.4297
Part Time Employment	3.8667	3.6000	3.9667	4.2333	3.6000
Self Employed	4.3485	3.7121	4.0455	3.9545	3.3636
Unemployed	4.0526	3.4737	3.7895	4.2632	3.1053
Total	4.0763	3.5449	3.7440	3.9121	3.4126

Table 5.11 Mean Scores for Motivational Adoption Factors by Job Status

In addition, a One Way ANOVA was conducted as shown in Table 5.12 below. The results show that all the p values were > .05, thus, there is no statistically significant difference between the various student job status and the individual motivational factors.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Cog_Need_Scale	Between Groups	2.120	3	.707	.784	.504
	Within Groups	307.537	341	.902		
	Total	309.657	344			
Aff_Need_Scale	Between Groups	.770	3	.257	.302	.824
	Within Groups	289.895	341	.850		
	Total	290.665	344			
Soc_Need_Scale	Between Groups	2.857	3	.952	1.066	.364
	Within Groups	304.638	341	.893		
	Total	307.494	344			
Sel_Eff_Scale	Between Groups	3.812	3	1.271	1.705	.166
	Within Groups	254.077	341	.745		
	Total	257.889	344			
Sub_Norm_Scale	Between Groups	2.285	3	.762	.707	.548
	Within Groups	367.328	341	1.077		
	Total	369.612	344			

Table 5.12 One Way ANOVA for Motivational Factors by Job Status

Having, analysed the adoption factors that focus on motivation to use mobile learning, that is, cognitive needs, affective needs, social needs, mobile learning self-efficacy and subjective norm. The study will now look into the pedagogical factors for adoption.

5.4 Pedagogical Factor for Adoption

In addition to motivational factors, this study also investigated pedagogical factors for adoption since mobile learning must remain grounded in fundamentals of teaching and learning. More importantly, mobile learning must be informed by theories of learning more so, theories of learning which are supportive of technology enhanced learning. In other words, the design of a mobile learning environment and activities must be aligned to the needs of learners' (Dennen and Hao 2014). Therefore, this section will present the results and findings in relation to research objective 2; to evaluate the pedagogical factors that influence behavioural intention of adult learners to use mobile learning.

The study revised the original Technology Adoption Models (TAM) adoption factors of Perceived Ease of Use and Perceived Usefulness, as postulated by Davies (1989), to bring it in line with a mobile learning context. Additionally, the study looked at Learning Relevance which is based on Theory of Reasoned Action by Fishbein and Ajzen (1975) Attitude towards behaviour which was also included in Davis et al (1989, pg. 985) TAM.

The analysis of these adoption factors are presented below, which made use of descriptive statistics for the construct's scale and its items. Each scale item was analysed as ordinal data, therefore, the results were presented using diverging stacked bar charts with discussion of level of agreement and disagreement from respondents. Additionally, for each construct a scale was derived using the weighted mean of the scale items. The mean of the construct was interpreted as follows: 1 - 2.33 **Low**, 2.34 - 3.66 **Moderate** and 3.67 - 5 **High**. Further analysis on these scales were done to examine if there is any significant difference among students with regards to gender, age groups and job status. This was done using an independent sample *t*-test and analysis of variance (ANOVA) test accordingly.

5.4.1 Learning Relevance

Attitude towards using mobile technologies for learning is important since it will have implications on the extent to which the learner views mobile learning as being relevant. This is based on Fishbein and Ajzen (1975, pg. 216) view that "as a person forms beliefs about an object, he automatically and simultaneously acquires an attitude toward that object". Therefore, by extension, the learners' perception of mobile learning relevance is linked to their general attitude towards learning and learning achievements (Park et al 2012). It is therefore important to evaluate the learners' attitude, whether favourable or not, towards using mobile learning in terms of relevance to their leaning needs. Especially, since intention to adopt mobile learning was found to be positively influenced by their attitude towards mobile learning (Hashim et al 2014; Park et al 2012).

In the context of mobile learning, the learners' attitude towards mobile learning will be a function of their evaluations of the relevance of the attributes of mobile learning (Fishbein and Ajzen 1975). In light of this, this study evaluated the respondents' favourableness in terms of learning relevance.

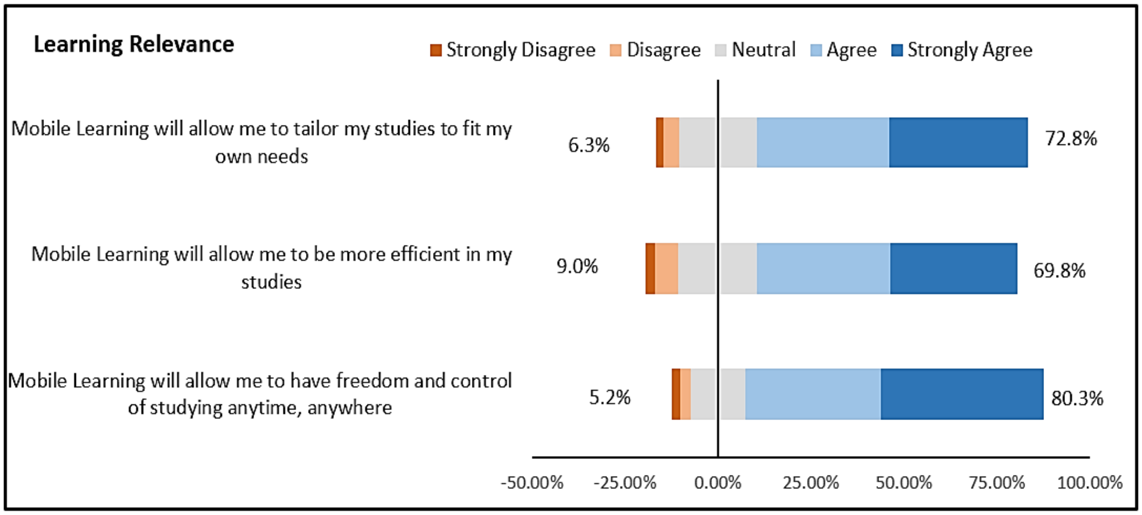

Figure 5.11 Learning Relevance

The results from the questions are presented in Figure 5.11 above. Not surprisingly, the majority of students (80%) agreed that mobile learning can afford them the opportunity and control to study anytime, anywhere. In other words, there is favourableness in terms being able to learn on the go, ubiquitously, independent of location. Additionally, 73% of students agreed as opposed to 6% who disagreed with regards to mobile learning aligning to their learning needs. More importantly, almost three quarters of the students expressed their view that mobile learning will allow them to be more efficient in their studies.

Overall, the results reveal there is **high** positive and favourable attitude towards mobile learning. This is indicative by a mean score of 4.03 ± 0.90 (M = 4.03, SD = 0.90).

5.4.2 Perceived Ease of Use

Perceived ease of use (PEOU) is one of two main constructs of the original and subsequent versions of the Technology Adoption Model (TAM). According to Davis (1989, pg. 320) PEOU refers to “the degree to which a person believes that using a particular system would be free of effort”. That is to say, ease of use is defined by users in terms of the reduced amount of physical and mental exertion required to use a system (Chavoshi and Hamidi 2018). Hence, Davis (1989) goes on further to opine that an application which is perceived to be easy is more likely to be accepted by the user.

In the context of mobile learning, PEOU refers to the learners' perception that the use of a mobile learning environment would be free of effort (Joo et al 2016). Therefore, PEOU relates to the ease of navigating the interface of a mobile learning application, learning how to use the application and easy access to learning materials (Hao et al 2017; Joo et al 2016; Sabah 2016).

The findings show that students perceived ease of use of mobile learning systems is **high** with a mean score of 3.93 ± 0.88 (M = 3.93, SD = 0.88). Looking at the individual scale items, 74% agreed that it will be easy to download and save learning content, with only 10% expressing disagreement (see Figure 5.12 below). Similarly, 73% agreed that it would be easy to become skillful at using mobile learning applications whilst only 5% disagreed.

This is understandable as mobile device manufacturers have focused heavily on creating user friendly designs and applications (Liu et al 2010). In addition, with respect to ease of learning how to use mobile learning applications, two thirds (66%) agreed and 8% disagreed with the statement, however 26% were uncertain of their ability to easily learn the new system.

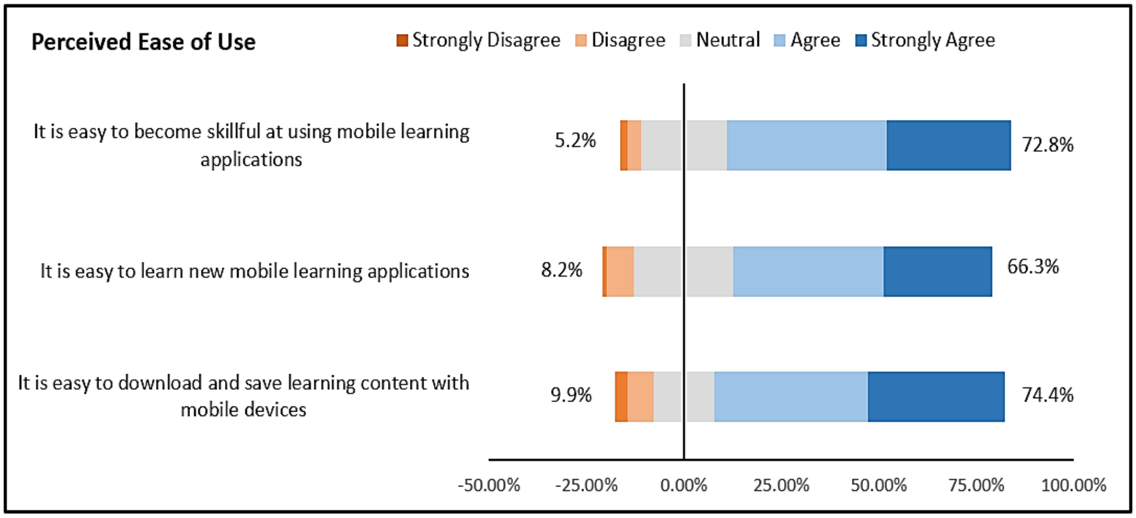

Figure 5.12 Perceived Ease of Use

5.4.3 Perceived Usefulness

The other main construct of TAM and its predecessors is perceived usefulness (PU). Davis (1989, pg. 320) purported that the word useful means that a system is capable of being advantageous. As such Davis defined PU as "the degree to which a person believes that using a particular system would enhance his or her job performance". In other words, PU is defined in terms of performance improvement from system use (Chavoshi and Hamidi 2018). From an education context, as students become highly motivated to obtain learning material and become a skilled learner's in order to achieve their educational goals, their perception of usefulness increases and should translate into positive intentions to adopt mobile learning (Davis 1989; Hao et al 2017; Hsia 2016).

Taken in the context of mobile learning, the question is whether or not learners perceive mobile learning as advantageous and capable of facilitating improvements in their level of engagement, course performance and educational goals (Hao et al 2017; Joo et al 2016). Moreover, these advantages include improvement in learning skills such as time management, communication, collaborative and creative thinking. Further advantages of using mobile learning encompass accomplishment of learning activities more quickly and flexibly (Sabah 2016).

In this regard, the results show that overall perceived usefulness is **high** (*M* = 3.91, *SD* = 0.91). Further to this, roughly three quarters of the students agreed that mobile learning can enable them to develop appropriate learning skills and accomplish learning activities more quickly and flexibly (see Figure 5.13 below). However, 65% viewed mobile learning as tool that can increase their academic performance which is slightly lower than the other scale items.

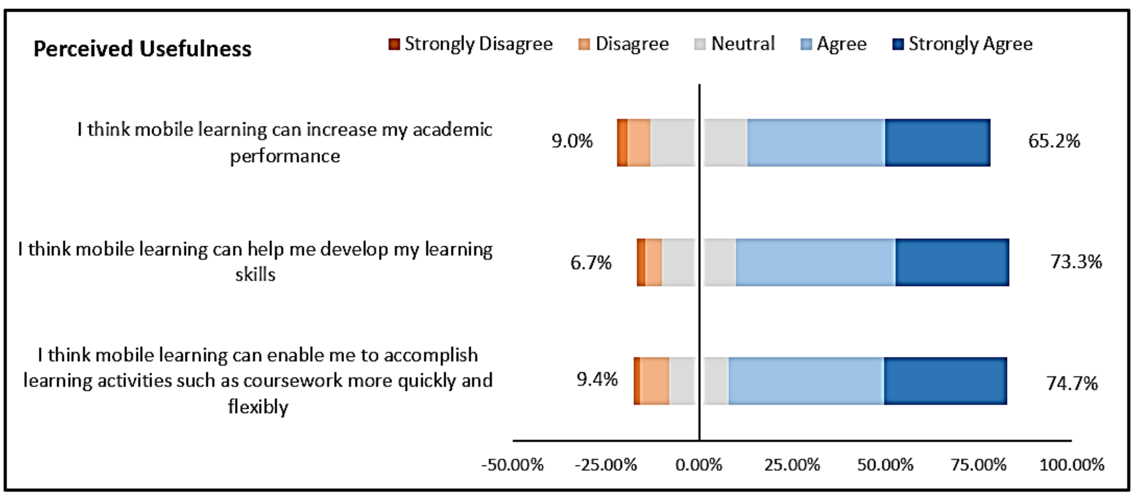

Figure 5.13 Perceived Usefulness

5.4.5 Summary of Pedagogical Factors

In this section a summary of the descriptive statistics for the pedagogical factors will be provided. Figure 5.14 below depicts in descending order the pedagogical constructs using the mean score. It is important to note that all the pedagogical adoption factors are above the theoretical mean of 3 on the scale, ranging from (*M* = 3.91 to 4.01). The comparison of mean scores, can give insights into the rank order of the strength of the individual pedagogical factors.

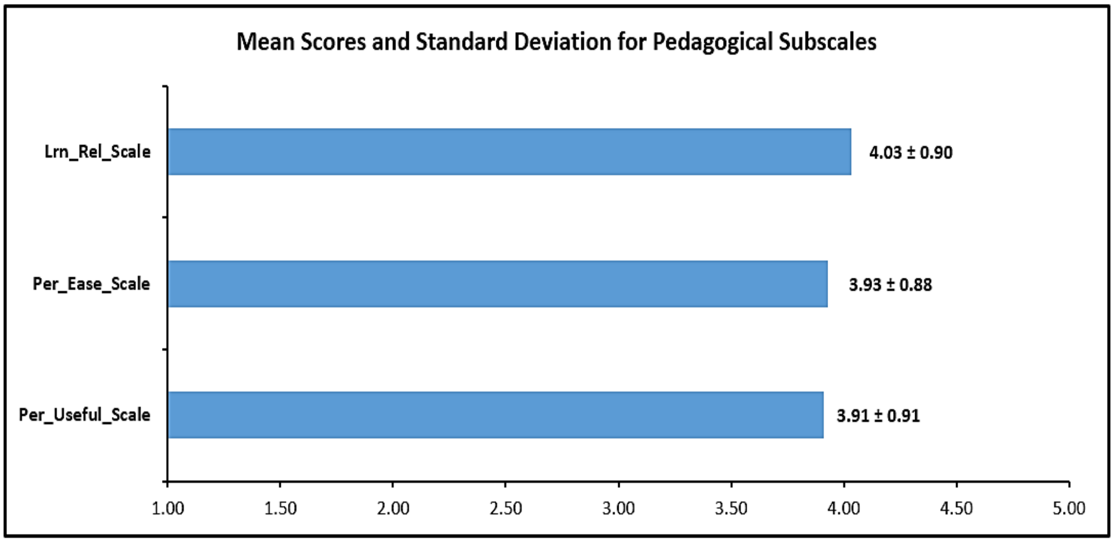

Figure 5.14 Summary of Pedagogical Adoption Factors

Thus, based on mean score only, the findings reveal that the strongest pedagogical influence for adoption would be learning relevance followed closely by perceived ease of use and perceived usefulness.

Additionally, the strength of the relationship among the pedagogical factors themselves and with behavioural intention was conducted using Pearson's correlation coefficient. As can be seen in Table 5.13 below, the strength of the relationship between the pedagogical factors and behavioural intention range from moderate positive to strong positive. Perceived usefulness ($r = 0.748$, $p < .01$) was found to be the best predictor of behavioural intention followed by moderate predictors of learning relevance ($r = 0.668$, $p < .01$) and perceived ease of use ($r = 0.608$, $p < .01$).

Correlations					
		Beh_Intention _Scale	Lrn_Rel _Scale	Per_Ease _Scale	Per_Useful _Scale
Beh_Intention_Scale	Pearson Correlation	1	.668**	.608**	.748**
	Sig. (2-tailed)		.000	.000	.000
	N	345	345	345	345
Lrn_Rel_Scale	Pearson Correlation	.668**	1	.636**	.750**
	Sig. (2-tailed)	.000		.000	.000
	N	345	345	345	345
Per_Ease_Scale	Pearson Correlation	.608**	.636**	1	.653**
	Sig. (2-tailed)	.000	.000		.000
	N	345	345	345	345
Per_Useful_Scale	Pearson Correlation	.748**	.750**	.653**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	345	345	345	345

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.13 Correlation of Behavioural Intention to Pedagogical Adoption Factors

Furthermore, the relationships among the pedagogical factors for adoption was found to be low to moderate, ranging from r = 0.636 to r = 0.750. So, given that the correlations between the pedagogical factors are not very strong (r > 0.9) as defined by Field (2009), there is no multicollinearity despite the significance of these correlations at the .01 level. This suggest that the individual pedagogical factors of learning relevance, perceived ease of use and perceived usefulness as predictors of intentions to adopt mobile learning are indeed measuring different attitudes.

5.4.6 Gender Differences in Pedagogical Factors

In order to investigate if there is any statistically significant difference among the students' attitude towards the various pedagogical factors for adoption in terms of gender, multiple independent samples *t*-tests were conducted. From the results as seen in Table 5.14 below (see test results from SPSS in Appendix 1), there is no statistically significant difference in two of the pedagogical factors, that is, learning relevance (t (343) = -1.660, p = .098) and perceived usefulness (*t* (343) = -0.515, p = .607). This suggest that both male and female students share a similar view that mobile learning is useful and relevant to their academic accomplishments. This result is consistent with the findings of Wang et al (2009) who did not find any significant difference effect of gender on the relationship between perceived usefulness and behavioural intentions. However, it contradicts other previous research, which found that the effect of perceived usefulness on behavioural intention is stronger in men than women (Venkatesh et al 2003; Tarhini et al 2014).

The study also found that the views on perceived ease of use, ((*t* (343) = -2.257, p = .0025) of mobile learning is statistically significantly different between male and female students, where the female students reported a higher mean (*M* = 4.02) compared to male students (*M* = 3.81). This is consistent with the work of Venkatesh et al (2003) who found that perceived ease of use effect on behavioural intentions is stronger for women compared to men. In contrast, Wang et al (2009) found that there is no support for the claim that the effect of effort expectancy (similar to perceived ease of use) on behavioural intentions is greater in women compared to men.

	Mean		**Standard Deviation**		**Result**	
	Male	Female	Male	Female	t	Sig
Learning Relevance	3.941	4.104	0.924	0.886	-1.660	0.098
Perceived Ease of Use	3.806	4.022	0.903	0.859	-2.257	0.025
Perceived Usefulness	3.884	3.935	0.885	0.929	-0.515	0.607

Table 5.14 Independent Samples *t*-test for Gender Differences in Pedagogical Adoption Factors

5.4.7 Age Differences in Pedagogical Factors

The study also looked at differences in perception to the pedagogical factors by age groups. Table 5.15 below shows the mean scores for each pedagogical factor across all age groups. It can be seen that for both learning relevance and perceived usefulness the mean scores are high across all age groups. Conversely, for perceived ease of use the mean scores for the age group 45-54 ($M = 3.62$) and 55+ ($M = 3.79$) are lower compared to the other age groups.

Mean Score for Pedagogical Factors by Age Group

Mean

Age_Group	Lrn_Rel_Scale	Per_Ease_Scale	Per_Useful_Scale
21-24	3.8846	4.1667	3.9744
25-34	3.9948	3.9767	3.9096
35-44	4.1221	3.9669	3.9059
45-54	3.9804	3.6209	3.9150
55+	4.0833	3.7917	3.8750
Total	4.0348	3.9304	3.9130

Table 5.15 Mean Score for Pedagogical Factors of Adoption by Age Groups

In order to investigate this possible difference a One Way ANOVA analysis was conducted as shown in Table 5.16 below. The results show that there is no statistically significant difference between age groups for learning relevance (F (4, 340) = .597, p = .665), perceived usefulness (F (4, 340) = 0.035 p = .998) and perceived ease of use (F (4, 340) = 2.259, p = .062). This implies that students' view the adoption of mobile learning to be useful, relevant to their learning outcomes and it is easy to use regardless of their age.

This finding contradicts those of earlier findings from previous researchers. For instance, Venkatesh et al (2003) found that the effect of performance expectancy (similar to perceived usefulness) on behavioural intentions was stronger in younger users than older users. However, from a mobile learning context, Wang et al (2009) found no support for younger user increasing the effect of performance expectancy (similar to perceived usefulness) on behavioural intentions.

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Lrn_Rel_Scale	Between Groups	1.962	4	.490	.597	.665
	Within Groups	279.399	340	.822		
	Total	281.360	344			
Per_Ease_Scale	Between Groups	6.942	4	1.735	2.259	.062
	Within Groups	261.166	340	.768		
	Total	268.108	344			
Per_Useful_Scale	Between Groups	.118	4	.029	.035	.998
	Within Groups	284.829	340	.838		
	Total	284.947	344			

Table 5.16 One Way ANOVA for Pedagogical Factors by Age Groups

Furthermore, with regards to perceived ease of use, according to Venkatesh et al (2003) and Wang et al (2009) the moderating effect of age on behavioural intention was stronger in older users.

5.4.8 Job Status Differences in Pedagogical Factors

In the case of job status, it was found that there is no significant difference in the views regarding the pedagogical factors as evident in Figure Table 5.18 below as all $p > .05$. Furthermore, the mean scores for all factors are high, across the various modes of employment as shown in Table 5.17 below.

Mean Score for Pedagogical Factors by Job Status			
Mean			
Job Status	Lrn_Rel_Scale	Per_Ease_Scale	Per_Useful_Scale
Full Time Employment	4.0125	3.8991	3.8719
Part Time Employment	4.2333	4.1667	4.2667
Self Employed	4.3485	4.1364	4.3485
Unemployed	3.9123	4.0526	3.8596
Total	4.0348	3.9304	3.9130

Table 5.17 Mean Score for Pedagogical Factors of Adoption by Job Status

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Lrn_Rel_Scale	Between Groups	2.991	3	.997	1.221	.302
	Within Groups	278.370	341	.816		
	Total	281.360	344			
Per_Ease_Scale	Between Groups	2.064	3	.688	.882	.451
	Within Groups	266.045	341	.780		
	Total	268.108	344			
Per_Useful_Scale	Between Groups	5.974	3	1.991	2.434	.065
	Within Groups	278.973	341	.818		
	Total	284.947	344			

Table 5.18 One Way ANOVA for Differences in Pedagogical Adoption Factors by Job Status

5.5 Constructivist Mobile Learning Preferences (CMLP)

This section of the analysis will address the results of the study pertinent to objective 3 of the research, that is, to explore the mobile learning preferences of adult learners based on the constructivist learning.

The constructivist learning environment require the learners to use an active rather than passive role, that is, they are responsible for their own learning, actively participating in discourse, reflection and problem solving (Beyan 2013; Yilirim 2014) with a community of learners as it will encourage further thinking (Fosnot and Perry 2005). Furthermore, Knuth and Cunningham (1993) insisted that learning should take place in contexts within which the learners are involved and care for and which is relevant to everyday life. Fosnot and Perry (2005) and Honebein (1996) concurs by suggesting that learning should occur in a meaningful, relevant and realistic context.

So, this means that the teachers' role in a constructivist learning environment is not that of a presenter of knowledge, that is, a teacher-centered approach. Rather, the role of teachers involves providing an enabling environment for knowledge construction by using a student-centered approach (Brooks and Brooks 1999). Furthermore, constructivist learning should utilize interactive and collaborative activities, where teachers act as an expert and guide.

This study developed the Constructivist Mobile Learning Preference (CMLP) measurement based on five scales derived from the literature (Chuang and Tsai 2005; Chu and Tsai 2005; Tsai 2008; Tsai et al 2012; Lai et 2016). The five scales are; Continuity (CO), Timely Guidance (TG), Adaptive Content (AC), Inquiry Learning (IL) and Student Negotiation (SN). The reliability (Cronbach Alpha coefficients) of these scales all exceeded the recommended threshold of 0.7 as seen in Table 5.19 below.

CMLP Sub Scales	**Cronbach Alpha coefficients (α)**
Continuity (CO)	0.84
Timely Guidance (TG)	0.90
Adaptive Content (AC)	0.80
Inquiry Learning (IL)	0.87
Student Negotiation (SN)	0.89

Table 5.19 Cronbach Alpha for CMLP Scales

The CMLP measurement sought to determine the preference for these features and attributes of a mobile learning environment based on a constructivist pedagogy. The overall reliability of the CMLP measurement was found to be high as confirmed by a Cronbach Alpha coefficient ($\alpha = 0.96$).

The CMLP measurement was interpreted using a weight mean score, where 1 - 2.33 **Low Preference**, 2.34 - 3.66 **Moderate Preference** and 3.67 - 5 **High Preference**. The results as seen in Table 5.20 below shows that the overall preference for a constructivist mobile learning environment is **high** as the mean score is 4.11 ± 0.76 (M = 4.11, SD = 0.76).

Descriptive Statistics			
	N	Mean	Std. Deviation
CMLP_Scale	345	4.1099	.75700
Valid N (listwise)	345		

Table 5.20 Descriptive Statistics for CMLP

Further insights into the specific features of the constructivist mobile learning environment revealed that the top feature is Student Negotiation (M = 4.15, SD = 0.83) followed by Inquiry Learning (M = 4.12, SD = 0.80) and Adaptive Content (M = 4.12, SD = 0.80), Timely Guidance (M = 4.09, SD = 0.83) and Continuity (M = 4.06, SD = 0.83) all with high levels of preference (as seen in Table 5.21 below). These findings are consistent with previous studies conducted by Chuang and Tsai (2005), Tsai (2008) and Tsai et al (2012) were students showed high preference towards a constructivist learning environment. Therefore, it can be implied that students prefer a constructivist mobile learning environment and that they are likely to prefer a student-centered approach to learning.

Descriptive Statistics			
	N	Mean	Std. Deviation
CMLP_CO	345	4.0638	.83020
CMLP_TG	345	4.0942	.82949
CMLP_AC	345	4.1174	.80333
CMLP_IL	345	4.1217	.80494
CMLP_SN	345	4.1522	.83049

Table 5.21 Descriptive Statistics for CMLP Scales

Table 5.22 below displays the result of comparing the mean scores between the scales using a paired samples *t* test. The predominant differences lie with continuity, that is, the results showed significance difference with all the other CMLP scales with the exception of timely guidance. The difference with the other scales is negative, this suggest that students prefer a mobile learning environment that provides adaptive content, inquiry learning and student negotiation outweigh their preference for learning continuity.

Paired Samples Test

		Paired Differences		
		Mean	Std. Deviation	Sig. (2-tailed)
Pair 1	CMLP_CO - CMLP_TG	-.03043	.46202	.222
Pair 2	CMLP_CO - CMLP_AC	-.05362	.45032	.028
Pair 3	CMLP_CO - CMLP_IL	-.05797	.49515	.030
Pair 4	CMLP_CO - CMLP_SN	-.08841	.58083	.005
Pair 5	CMLP_TG - CMLP_AC	-.02319	.45050	.340
Pair 6	CMLP_TG - CMLP_IL	-.02754	.47154	.279
Pair 7	CMLP_TG - CMLP_SN	-.05797	.60961	.078
Pair 8	CMLP_AC - CMLP_IL	-.00435	.35863	.822
Pair 9	CMLP_AC - CMLP_SN	-.03478	.52018	.215
Pair 10	CMLP_IL - CMLP_SN	-.03043	.52945	.286

Table 5.22 Paired t tests for Means of CMLP Scales

Therefore, the priority of preferred features for a constructivist mobile learning environment can be derived from the analysis above. As shown in Figure 5.15 below, the highest priority preference to consider when designing a mobile learning environment is student negotiation followed by inquiry learning, adaptive content, timely guidance, and lowest preference for continuity of learning. Interestingly, Chuang and Tsai (2005) and Tsai (2008) found student negotiation to be among the least preferred feature, this study contradicts those findings. But in later studies by Tsai et al (2012) and Lai et al (2016) it was found that student negotiation was among the top feature preferred by students.

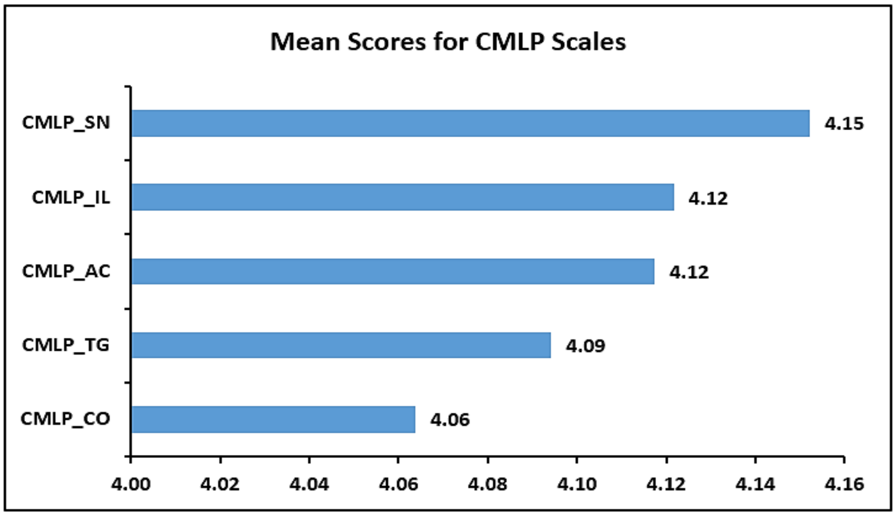

Figure 5.15 Mean Scores for CMLP Scales

This is mainly due to the fact that the older studies were based on an internet based learning environment whereas the newer studies of Tsai et al (2012) and Lai et al (2016) were based on a ubiquitous and mobile learning environment respectively. The shift can also be explained by students' increase social interaction through the use of social networking applications accessible on mobile devices. Therefore, students are now reconciling everyday life activities with learning activities in light of access through mobile devices. In other words, students prefer to have the opportunity to communicate and collaborate with other to construct knowledge in a community rather than independently.

To gain further insights in terms of the preferred teaching and learning approach to be used in a mobile learning environment, the CMLP measurement was broken down into a grouping variable.

This was done by using a split procedure where $M = 3.67$, to represent the polar extremes of the scale, in order to determine the preference for either a student centered or teacher centered learning environment. The findings are indicative of the literature (Chuang and Tsai 2005; Tsai 2008; Chu and Tsai 2009; Tsai et 2012; Lai et 2016) that the majority of learners prefer a student-centered environment (80.3%) compared to teacher-centered preference (19.7%) as shown in Figure 5.16 below.

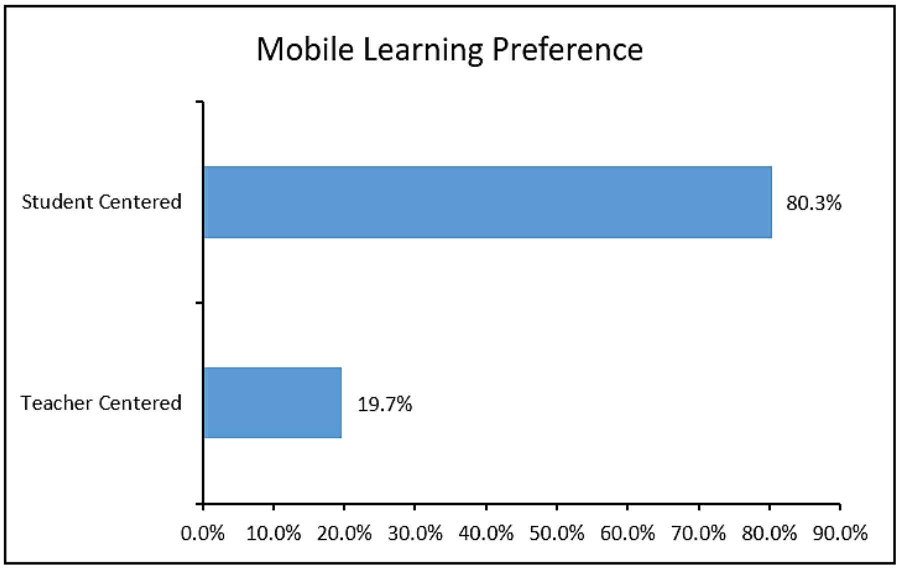

Figure 5.16 Mobile Learning Preference Categorization

Further analysis to investigate the difference in adoption intention by CMLP category was conducted using a One Way ANOVA as seen below in Table 5.23. The results reveal a statistically significant difference in behavioral intentions between the polar extremes of the CMLP scale, that is, student centered and teacher centered strategies (F (1, 343) = 126.99, p = .000).

ANOVA					
Beh_Intention_Scale					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	79.864	1	79.864	126.986	.000
Within Groups	215.719	343	.629		
Total	295.583	344			

Table 5.23 One Way ANOVA for Behavioural Intention by CMLP

As can be on the means plot shown below in Figure 5.17, the mean score for behavioural intention is significantly higher when the students prefer a student centered approach (M = 4.07), in contrast when the students prefer a teacher centered approach (M = 2.86).

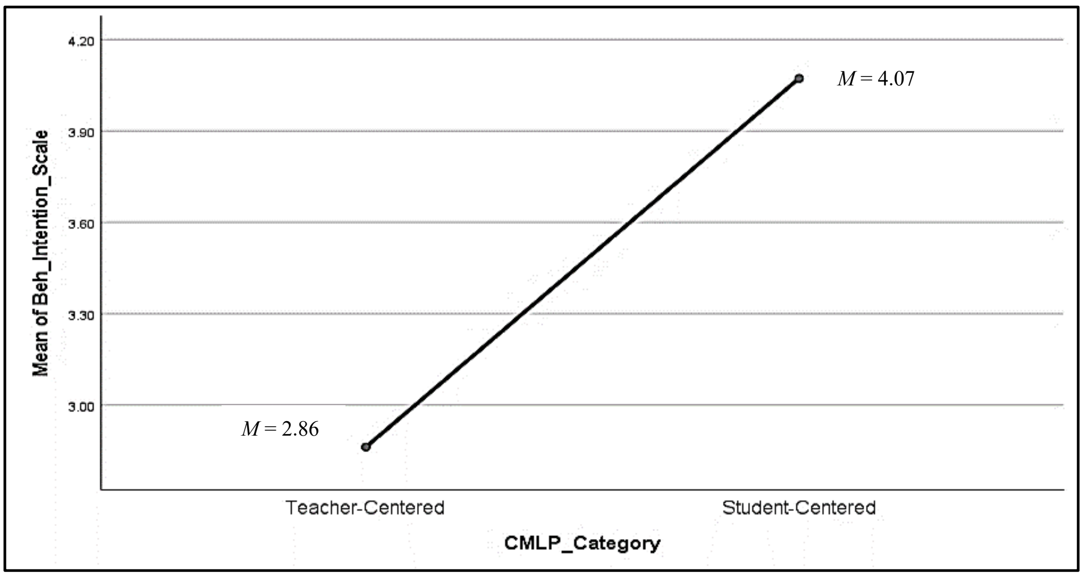

Figure 5.17 Means Plot for Behavioural Intention by CMLP Category

This implies that there is a positive relationship between behavioural intention and CMLP, that is, the increase in preference for a constructivist mobile learning environment will increase the intentions for mobile learning adoption. This is confirmed by the Pearson's Correlation coefficient ($r = 0.698$, $p < .01$) as shown in Table 5.24 below. Additionally, the CMLP scale explains 49% of the variance ($R^2 = .487$) in the dependent variable behavioural intention to adopt mobile learning (see Figure 5.18 below).

Correlations			
		Beh_Intention_Scale	CMLP_Scale
Beh_Intention_Scale	Pearson Correlation	1	.698**
	Sig. (2-tailed)		.000
	N	345	345
CMLP_Scale	Pearson Correlation	.698**	1
	Sig. (2-tailed)	.000	
	N	345	345

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.24 Pearson's correlation between Behavioural Intention and CMLP

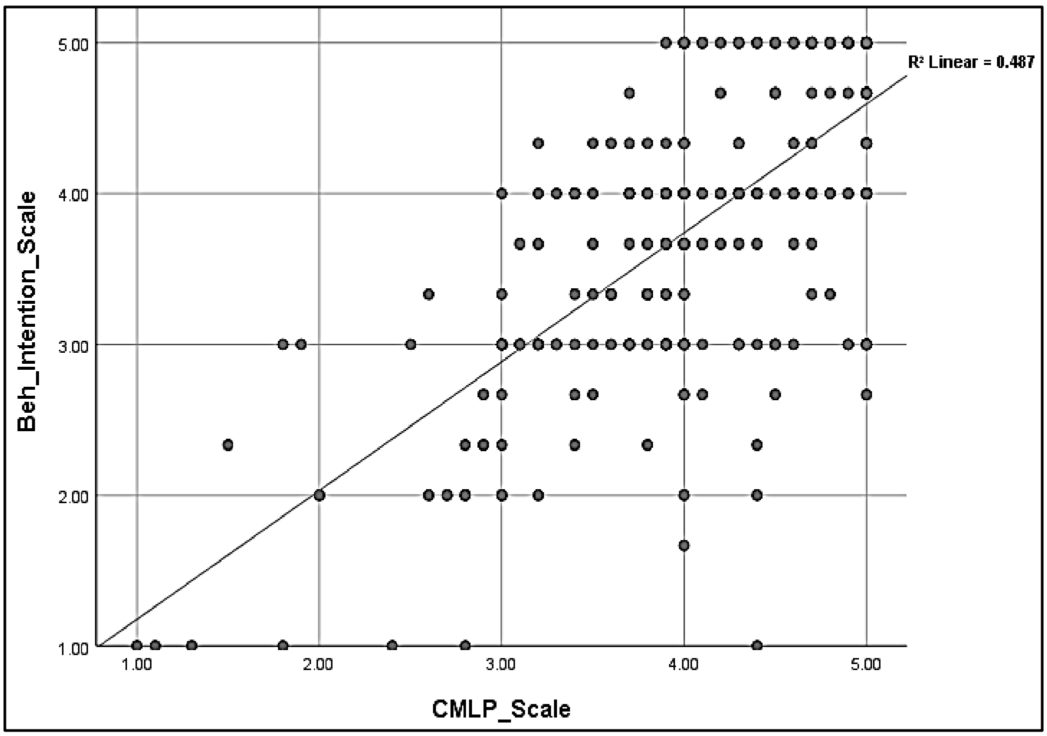

Figure 5.18 Scatter Plot with Fit Line Behavioural Intention by CMLP

5.5.1 Gender Differences in CMLP

Further exploration was conducted regarding gender differences on the CMLP scales as shown in Table 5.25 below. The results reveal that for all scales, female students showed marginally higher preference compared to their male counterparts in terms of their score for the features of constructivist mobile learning environment.

In order to confirm whether these differences are significant, multiple independent samples *t*-tests were conducted. From the results as seen in Table 5.25 (see test results from SPSS in Appendix 1), there is no statistically significant difference in the mean scores of male and female students across all the CMLP scales, since the significance value (p) is greater than .05 ($p > .05$) in all cases.

	Gender	N	Mean	t value	Sig (p)
CMLP_CO	Male	146	4.0205	-.828	.41
	Female	199	4.0955		
CMLP_TG	Male	146	4.0240	-1.35	.18
	Female	199	4.1457		
CMLP_AC	Male	146	4.0616	-1.10	.27
	Female	199	4.1583		
CMLP_IL	Male	146	4.0514	-1.39	.17
	Female	199	4.1734		
CMLP_SN	Male	146	4.1199	-.62	.54
	Female	199	4.1759		

Table 5.25 Gender Differences of the CMLP Scales

Overall, the CMLP measurement does not show any significant difference in score by gender as well as shown below in Table 5.26, as $t(343) = -1.14$, $p = .254$.

Independent Samples Test

		Levene's Test for Equality of Variances				
		F	Sig.	t	df	Sig. (2-tailed)
CMLP_Scale	Equal variances assumed	.014	.904	-1.143	343	.254
	Equal variances not assumed			-1.144	313.717	.253

Table 5.26 Independent t test for Gender Differences in CMLP

These findings are consistent with those of Chuang and Tsai (2005), Chu and Tsai (2009) and Tsai et al (2012), that is, both male and female students share similar preferences for a constructivist mobile learning environment. They are however interesting, as it contradicts previous studies as cited by Chuang and Tsai (2005, pg. 263), that suggest "females were usually more anxious and showed negative attitudes towards computer-related learning environments".

5.5.2 Age Differences in CMLP

Looking now at differences by age group on CMLP scales as shown firstly in Table 5.27 below, the results show that among all age groups the preference for continuity, timely guidance, adaptive content, inquiry learning and student negotiation was high ($M > 4$).

Case Summaries

Mean

Age_Group	CMLP_CO	CMLP_TG	CMLP_AC	CMLP_IL	CMLP_SN
21-24	3.9038	4.0962	4.0385	4.0000	4.0577
25-34	4.0271	4.0155	4.1047	4.0736	4.1202
35-44	4.0954	4.2099	4.1641	4.1756	4.1565
45-54	4.1275	3.9706	4.0588	4.1078	4.2059
55+	4.2500	4.2500	4.1875	4.5000	4.5625
Total	4.0638	4.0942	4.1174	4.1217	4.1522

Table 5.27 Mean Score for CMLP Scales by Age Groups

Secondly, further analysis was done to test for statistically significant differences, the ANOVA test displayed in Table 5.28 reveals that there were no significant differences between age groups of students with regards to their preferences for a constructivist mobile learning environment. This implies that all age groups value the features and attributes of the constructivist mobile learning environment in a similar way and that the adage that younger adults are more inclined to technology enhanced learning than older adults can be refuted.

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
CMLP_CO	Between Groups	1.454	4	.363	.524	.718
	Within Groups	235.643	340	.693		
	Total	237.097	344			
CMLP_TG	Between Groups	3.527	4	.882	1.286	.275
	Within Groups	233.162	340	.686		
	Total	236.688	344			
CMLP_AC	Between Groups	.683	4	.171	.262	.902
	Within Groups	221.312	340	.651		
	Total	221.996	344			
CMLP_IL	Between Groups	2.218	4	.554	.854	.492
	Within Groups	220.669	340	.649		
	Total	222.887	344			
CMLP_SN	Between Groups	1.861	4	.465	.672	.612
	Within Groups	235.400	340	.692		
	Total	237.261	344			

Table 5.28 ANOVA for CMLP Scales by Age Groups

5.5.3 Job Status Difference in CMLP

The study also investigated the differences by job status in the CMLP scales. Similar, to age groups, the results show (see Table 5.29) that among all job status groups, the preference for timely guidance, adaptive content, inquiry learning and student negotiation was high ($M > 4$) scores across job status groups.

Case Summaries					
Mean					
Job Status	CMLP_CO	CMLP_TG	CMLP_AC	CMLP_IL	CMLP_SN
Full Time Employment	4.0374	4.0782	4.0918	4.1003	4.1293
Part Time Employment	4.2000	4.2000	4.3500	4.4500	4.3500
Self Employed	4.4318	4.2955	4.3182	4.3636	4.4318
Unemployed	3.9737	4.0526	4.1579	4.0000	4.0789
Total	4.0638	4.0942	4.1174	4.1217	4.1522

Table 5.29 Mean Score for CMLP Scales by Job Status

The One-Way ANOVA results shown in Table 5.30 below confirmed that there were no significant differences between job status groups in their preference for a constructivist mobile learning environment. This suggest that students regardless of their job status appreciate a constructivist mobile learning environment. This is noteworthy and explainable since earlier findings showed that the majority students spend 1 to 4 hours daily on learning activities regardless of their employment status while enrolled in a course. Additionally, students most frequently used their mobile device either at home (47.2%) or at work (39.7%) and students spend an average of 6 hours (*M* = 5.8 hours) on their mobile device daily.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
CMLP_CO	Between Groups	3.524	3	1.175	1.715	.164
	Within Groups	233.573	341	.685		
	Total	237.097	344			
CMLP_TG	Between Groups	1.111	3	.370	.536	.658
	Within Groups	235.578	341	.691		
	Total	236.688	344			
CMLP_AC	Between Groups	1.651	3	.550	.852	.466
	Within Groups	220.344	341	.646		
	Total	221.996	344			
CMLP_IL	Between Groups	2.781	3	.927	1.436	.232
	Within Groups	220.106	341	.645		
	Total	222.887	344			
CMLP_SN	Between Groups	2.368	3	.789	1.146	.331
	Within Groups	234.893	341	.689		
	Total	237.261	344			

Table 5.30 ANOVA for CMLP Scales by Job Status

Overall, with respect to the CMLP measurement, there is a high level of preference for a mobile learning environment to be designed using constructivist pedagogy. Students expressed strong preference for the features and attributes of Continuity (CO), Timely Guidance (TG), Adaptive Content (AC), Inquiry Learning (IL) and Student Negotiation (SN) features. More importantly, the results imply that a well-designed constructivist mobile learning environment should make no difference to students regardless of their gender, age groups and job status.

5.6 Behavioural Intention

Behavioural intention (BI) is defined under Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975, pg. 288) as "a person's subjective probability that he will perform some behaviour". Therefore, "BI is a measure of the strength of one's intention to perform a specified behaviour" (Davis et al 1989, pg. 984). In other words, a person's willingness to actually use an application is directly affected by their intention to perform the behaviour because according to Joo and Sang (2013, pg. 2513) people "generally behave as they intend to".

In the context of this study, mobile learning adoption is predicated on the learner's behavioural intention towards mobile learning. Therefore, this study sought to find out the extent to which students' have positive intentions to perform mobile learning. This section will therefore provide the preliminary analysis of the dependent variable for this research, thereafter, further analysis can be conducted on its predictors.

Overall, the results revealed that the strength of BI was found to be **high** as the mean score is 3.83 ± 0.93 (M = 3.93, SD = 0.93). As can be seen in Figure 5.19 below, overall, two thirds of the students agreed to having intentions to perform mobile learning and to positively utilize it. Additionally, 70% think others should use mobile learning as well.

To gain further insights in terms of the degree or level of behavioural intention of students to adopt mobile learning, the behavioural intention scale was broken down into a grouping variable.

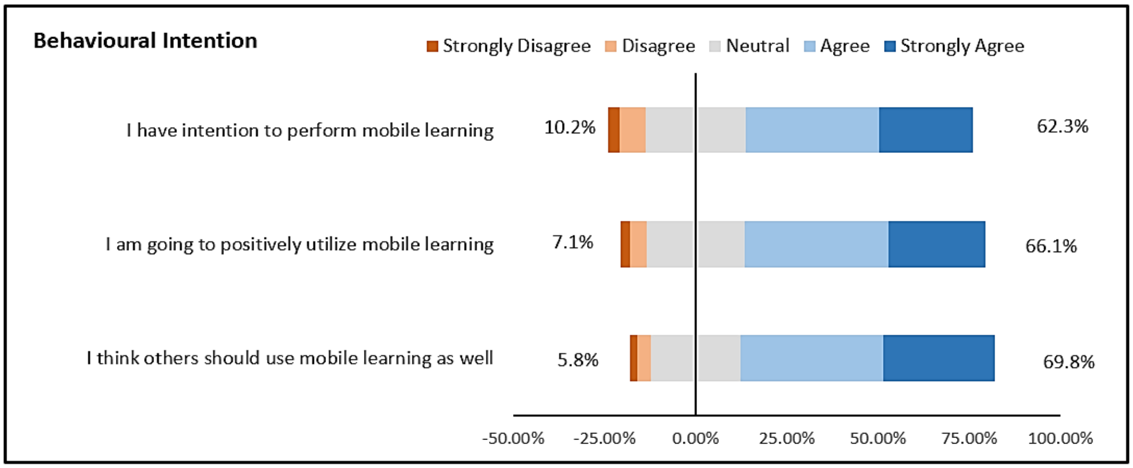

Figure 5.19 Behavioral Intention

This was done by using a split procedure where M = 3.67, to represent the polar extremes of the scale, in order to determine the number of students who have a high and low degree of intention to adopt mobile learning. The majority of learners (see Figure 5.20 below) demonstrated a high intent to adopt mobile learning (66%) compared to those who demonstrated a low intent to adopt (34%).

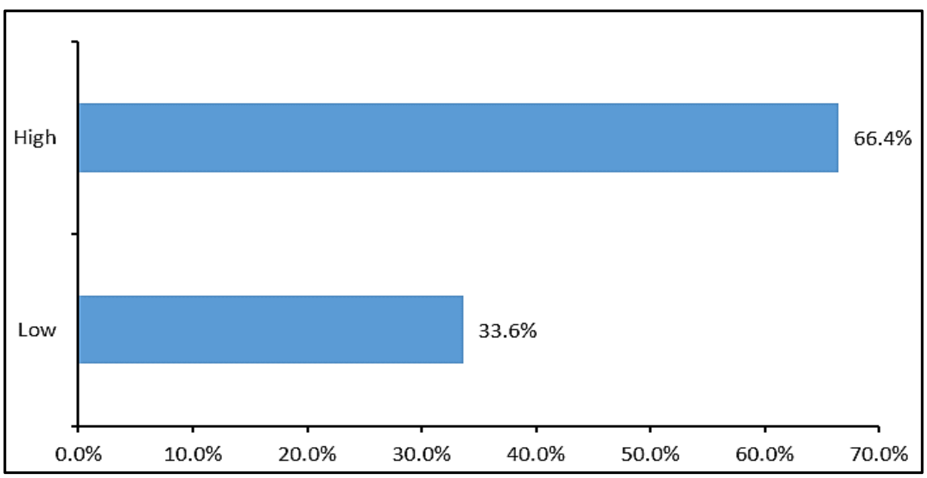

Figure 5.20 Behavioural Intention Categorization

5.6.1 Gender Differences in Behavioural Intention

In order to investigate if there is any statistically significant difference among the students' behavioural intention for adoption in terms of gender, an independent samples *t*-test was conducted. Upon looking at Table 5.31, the result shows that there is little difference in the mean score by gender. This is confirmed by the *t*-test result in Table 5.32 below where (t (343) = 0.736, p = .46). Thus, there is no statistically significant difference in behavioural intention between male and female students.

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Beh_Intention_Scale	Male	146	3.8767	.90973	.07529
	Female	199	3.8023	.94043	.06667

Table 5.31 Mean Score for Behavioural Intention by Gender

Independent Samples Test							
		Levene's Test for Equality of Variances					
		F	Sig.	t	df	Sig. (2-tailed)
Beh_Intention_Scale	Equal variances assumed	.033	.855	.736	343	.462
	Equal variances not assumed			.740	318.241	.460

Table 5.32 Independent Samples *t*-test for Gender Differences in Behavioural Intention

Several studies suggest that gender plays a role in mediating user behavioural intention to use a system. For instance, Venkatesh et al (2000), Venkatesh et al (2003) found that variance explained for behavioural intention increased when gender was included as a moderator. Additionally, Tarhini et al (2014) found that the effect was stronger for male users. Conversely, in an educational context, similar to this study's results, Al-Emran (2016) found no significant difference among students behavioural intention to adopt with respect to their gender. This is noteworthy as it contradicts previous studies purporting that technology usage is male dominated.

5.6.2 Age Differences in Behavioural Intention

Turning now to determining if there is any significant difference in BI with respect to age. Firstly, the BI mean score for each age group is shown in Table 5.33 below, behavioural intention is highest in the age group 21-24 year-old (M = 3.94), whereas the lowest level of adoption intention is in the age group 55+ (M = 3.79). This is understandable as this age group represents the digital immigrants as compared to the 21-24 year olds who are digital natives. Nevertheless, a One Way Analysis of Variance (ANOVA) was performed to test for statistical difference between age groups as shown in Table 5.34 below.

Mean	
Age_Group	Beh_Intention_Scale
21-24	3.9359
25-34	3.8088
35-44	3.8321
45-54	3.8562
55+	3.7917
Total	3.8338

Table 5.33 Mean Score for Behavioural Intention by Age Group

ANOVA

Beh_Intention_Scale

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.392	4	.098	.113	.978
Within Groups	295.191	340	.868		
Total	295.583	344			

Table 5.34 One Way ANOVA for Behavioural Intention by Age Group

The ANOVA showed that the effect of age was not significant since F (4, 344) = .113, p = .978. Thus, there is no statistical difference in behavioural intention to adopt mobile learning by age.

Studies have shown that age is key factor which moderates behavioural intentions (Tarhini et al 2014). Most studies found that most of the determinants of behavioural intentions were significantly different in the younger age group compared to the older age group (Wang et al 2009). Furthermore, Al-Emran et al (2016) found that there is significant difference in the mean scores among the various age groups, but was unable to determine where the difference occurred. This study contradicts previous research, in that, the study advances that there is no significant difference between age groups, regarding students behavioural intentions to adopt mobile learning.

5.6.3 Job Status Differences in Behavioural Intention

In terms of differences in behavioural intention to adopt mobile learning with respect to job status, an ANOVA test was conducted. The results shown, as seen in Table 5.35, that the effect of job status was not significant since $F(3, 344) = 1.375$, $p = .250$. Thus, there is no statistical difference in behavioural intention to adopt mobile learning by job status.

ANOVA

Beh_Intention_Scale

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.533	3	1.178	1.375	.250
Within Groups	292.050	341	.856		
Total	295.583	344			

Table 5.35 One Way ANOVA for Behavioural Intention by Job Status

5.6.4 CMLP Differences in Behavioural Intentions

It was also useful to assess the relationship between the constructivist mobile learning preference categories and the behavioural intention categories to determine if there are differences in the intent to adopt based on the learner preference for a constructivist mobile learning environment.

This was done by first conducting a Chi-Square test as shown in Table 5.36 below, the results reveal the there is a statistically significant difference in the level of behavioural intention based on the learners' preference for a constructivist mobile learning environment, since $p < .05$ (X^2 [1, n=345] = 84.76, p = .000).

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	84.755[a]	1	.000		
Continuity Correction[b]	82.138	1	.000		
Likelihood Ratio	82.152	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	84.509	1	.000		
N of Valid Cases	345				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 22.86.

b. Computed only for a 2x2 table

Table 5.36 Chi- Square Test for Differences in Behavioural Intention by CMLP

Further analysis as shown in Figure 5.21 reveals that for those students who preferred a teacher centered approach there were more students who demonstrated lower intention to adopt mobile learning (16%) as compared to high intention (4%). Moreover, for those students who preferred a student centered approach there were more students who demonstrated higher levels of intention to adopt (63%) compared to lower intentions (18%).

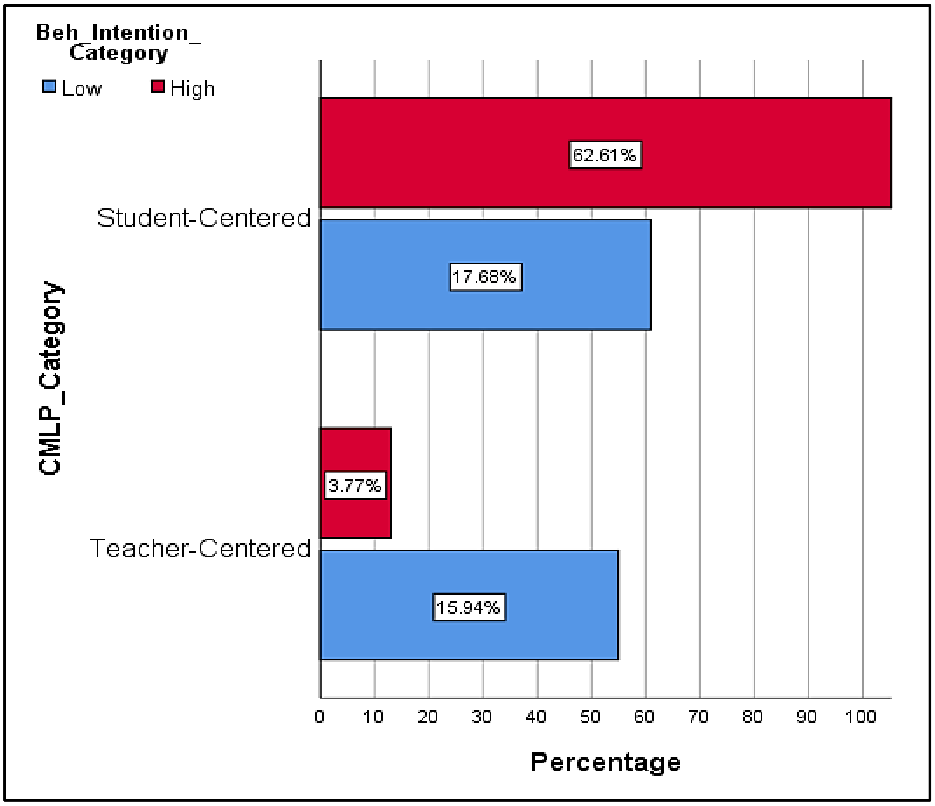

Figure 5.21 Behavioural Intention Category by CMLP Category

5.6.4 Correlation of Adoption Factors to Behavioural Intention

With respect to the strength and direction of the relationship between the individual influencing factors of behavioural intention and students' behavioural intention to adopt, a Pearson's correlation was done. The correlation matrix in Table 5.37 below shows that all relationships are significantly positive and range from moderate to high strength.

Interestingly, the strongest relationship and predictor of behavioural intention are the pedagogical factors of perceived usefulness ($r = .748$, $p < .01$), CMLP ($r = .698$, $p < .01$), learning relevance ($r = .668$, $p < .01$) and perceived ease of use ($r = .608$, $p < .01$). Then followed by the motivational factors of affective need ($r = .570$, $p < .01$), subjective norm ($r = .477$, $p < .01$), cognitive need ($r = .436$, $p < .01$), self-efficacy ($r = .420$, $p < .01$) and the lowest social need ($r = .405$, $p < .01$).

	Beh_Intention_Scale		
	Pearson Correlation	Sig. (2-tailed)	N
Beh_Intention_Scale	1		345
Cog_Need_Scale	.436**	.000	345
Aff_Need_Scale	.570**	.000	345
Soc_Need_Scale	.405**	.000	345
Sel_Eff_Scale	.420**	.000	345
Lrn_Rel_Scale	.668**	.000	345
Sub_Norm_Scale	.477**	.000	345
Per_Ease_Scale	.608**	.000	345
Per_Useful_Scale	.748**	.000	345
CMLP_Scale	.698**	.000	345

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.37 Correlation Matrix Behavioural Intention and Adoption Factors

So, given the positive moderate to high connection, it means that the higher the students' perception that their pedagogical and motivational needs are being fulfilled from mobile learning usage, the higher their intention to adopt will be. In order to further investigate where exactly the explanations lie for these relationships and the nature of the relationships between the independent variables and the dependent variable Structural Equation Modelling (SEM) was used.

5.7 Structural Equation Modelling (SEM)

This section of the analysis will focus on evaluating the relationships and the effects between the various motivational and pedagogical factors as well as the constructivist mobile learning preference of students and behavioural intention to adopt mobile learning. So, in essence, this section of the analysis allows for the achievement of the research objectives with respect to evaluating the influence of the adoption factors on behavioural intentions.

The researcher employed the use of exploratory SEM or model generation rather than based on strict confirmatory SEM (Kline 2011). The idea behind this approach was to discover a parsimonious model that can best explain behavioural intention to adopt mobile learning. Therefore, the researcher iteratively applied the SEM process until an acceptable model was generated using the factors under study. According to Hair et al (2010) the criteria for an acceptable model is one that achieves model fit, path estimates are significant and in the proposed direction and the variance explained R^2 is maximized.

The final model presented here is the result of the sixth (6th) iteration in the discovery process, the previous models generated can be found in Appendix 6.

5.7.1 Measurement Model- Reliability and Validity

In order to analyse and verify the quality of the measurement model, both reliability and validity were examined.

Firstly, the results showed that the scale items fit their respective constructs as well as the Cronbach Alpha (α) value for each construct ranged from 0.768 to 0.962 (see Table 5.38 below). All of the constructs; Mobile Learning Self Efficacy (SE), Learning Relevance (LR), Perceived Ease of use (PEOU), Perceived usefulness (PU), Cognitive need (CN), Social need (SN), Subjective norm (Sub Norm) and Behavioural intentions(BI) are at excellent levels, while Affective Need (AN) is at a good level. Overall, alpha values exceeded the acceptable threshold value of 0.7 (Hair et al. 2010) in all cases. Furthermore, the composite reliability (CR) values for each construct also exceeded the recommended threshold of 0.7 in all cases, with values ranging from 0.784 to 0.963. Therefore, this indicates that the constructs are reliable.

Secondly, evaluation of convergent validity was done using the factor loadings and average variance extracted (AVE). It was found that all but one of the items (Affective Need 1) loaded strongly, that is, above the acceptable threshold of 0.7 (Fornell and Larcker 1981). Furthermore, the AVE were all well above 0.5 recommended level (Hair et al 2010), thereby demonstrating that a good level of internal consistency was achieved.

Lastly, the results in Table 5.39 below shows the square root of the AVE, which are shown as bold and the inter-correlation between constructs in the model. According to (Fornell and Larcker 1981) discriminant validation is verified when the square root of the AVE for each construct is greater than the correlation to any other construct. Looking down each column in the table, it can be seen that for each of the construct the square root AVE values are indeed greater than any other correlation value. Therefore, the measurement model discriminant validity has been verified.

In summary, from the results discussed and analysed above, the proposed model demonstrated strong reliability and validity.

Construct	Items	Cronbach's Alpha	Factor Loadings	Average Variance Extracted (AVE)	Composite Reliability (CR)
Cognitive Need	Cog_Need3	**0.845**	0.917	**0.664**	**0.854**
	Cog_Need2		0.713		
	Cog_Need1		0.802		
Affective Need	Aff_Need3	**0.768**	0.760	**0.553**	**0.784**
	Aff_Need2		0.860		
	Aff_Need1		0.584		
Social Need	Soc_Need3	**0.829**	0.749	**0.630**	**0.836**
	Soc_Need2		0.802		
	Soc_Need1		0.828		
Self Efficacy	Sel_Eff3	**0.907**	0.865	**0.774**	**0.911**
	Sel_Eff2		0.948		
	Sel_Eff1		0.822		
Learning Relevance	Lrn_Rel3	**0.917**	0.932	**0.794**	**0.920**
	Lrn_Rel2		0.917		
	Lrn_Rel1		0.820		
Subjective Norm	Sub_Norm3	**0.868**	0.767	**0.697**	**0.873**
	Sub_Norm2		0.906		
	Sub_Norm1		0.826		
Perceived Ease of Use	Per_Ease3	**0.902**	0.907	**0.765**	**0.907**
	Per_Ease2		0.903		
	Per_Ease1		0.810		
Perceived Usefulness	Per_Useful3	**0.932**	0.910	**0.825**	**0.934**
	Per_Useful2		0.940		
	Per_Useful1		0.874		
Constructivist Mobile Learning Preference	MLP_CO2	**0.962**	0.838	**0.720**	**0.963**
	MLP_CO1		0.850		
	MLP_SN2		0.854		
	MLP_SN1		0.756		
	MLP_AC2		0.861		
	MLP_AC1		0.849		
	MLP_IL2		0.835		
	MLP_IL1		0.900		
	MLP_TG2		0.867		
	MLP_TG1		0.870		
Behavioural Intention	Beh_Int3	**0.949**	0.898	**0.865**	**0.951**
	Beh_Int2		0.969		
	Beh_Int1		0.922		

Table 5.38 Reliability and Convergent Validity Results

	CN	AN	SN	SE	SNorm	LR	PEOU	PU	BI	CMLP
CN	**0.815**									
AN	0.657	**0.743**								
SN	0.589	0.595	**0.794**							
SE	0.503	0.560	0.426	**0.880**						
SNorm	0.308	0.477	0.474	0.201	**0.835**					
LR	0.574	0.680	0.531	0.472	0.544	**0.891**				
PEOU	0.514	0.582	0.470	0.558	0.401	0.666	**0.874**			
PU	0.537	0.644	0.446	0.424	0.532	0.801	0.696	**0.908**		
BI	0.505	0.669	0.450	0.430	0.500	0.707	0.650	0.785	**0.930**	
CMLP	0.539	0.558	0.500	0.461	0.496	0.741	0.679	0.725	0.722	**0.849**

Table 5.39 Inter-Correlation Matrix and Square Root of AVE

5.7.2 Measurement Model- Model Fit Analysis

Confirmatory Factor Analysis was used to evaluate the extent to which the model fits the data and to ensure that there are no discrepancies and that the data speaks to the model (Kline 2011) by using Goodness of Fit Indices. Therefore, various goodness of fit estimates was used to evaluate the model fit, namely absolute fit indices, approximate fit indices and incremental fit indices.

The results of these test are shown in Table 5.40 below, RMR was .046, RMSEA was .066, Chi Square degree of freedom ratio was 2.498, TLI and CFI were more than the recommended value of .90. However, GFI and CFI were .811 and .884 respectively, which is acceptable, given the recommended value of .90. So overall, the measurement model demonstrates good fit with the data.

Model Test Statistics	Obtained Values	Recommended Values (Hair et al 2010)	Criteria Met?
(CMIN/ df) ratio	2.498	< 3	Yes
Root Mean Squared Residual (RMR)	0.046	< 0.1	Yes
Root Mean Square Error of Approximation (RMSEA) |90% Confidence Interval|	0.066 |0.062-0.070|	< 0.08	Yes
Goodness of Fit Index (GFI)	0.811	> 0.9	Acceptable
Tucker Lewis Index (TLI)	0.916	> 0.9	Yes
Normal Fit Index (NFI)	0.884	> 0.9	Acceptable
Comparative Fit Index (CFI)	0.926	> 0.9	Yes

Table 5.40 Model Fit Indices for Measurement Model

5.7.3 Structural Model

The structural model specifies the proposed model that explain behavioural intention to adopt mobile learning, but more importantly it allows the researcher to test the interrelated dependence relationships between the exogenous and endogenous latent variables. The path diagram presented below in Figure 5.22, is the result of six iterations of exploration in order to discover the proposed model.

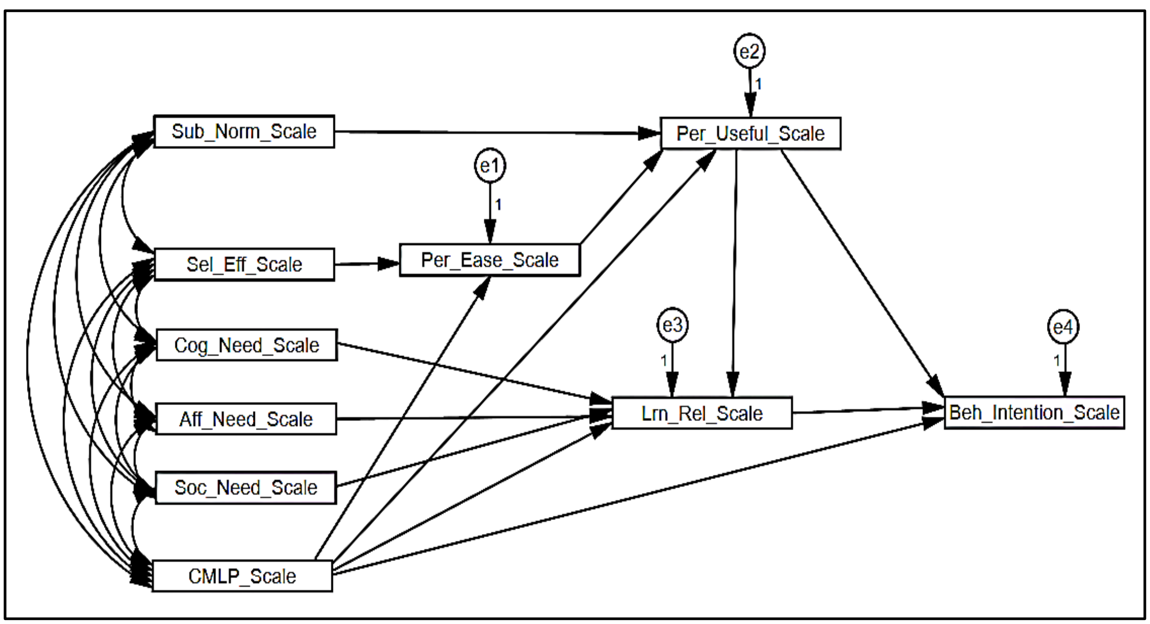

Figure 5.22 Path Diagram of Structural Model

The model therefore specifies thirteen (13) hypotheses to be tested as shown in Table 5.41. Regarding the motivational factors, there were 5 hypotheses tested, in terms of pedagogical factors there were 4 hypotheses tested and with respect to constructivist mobile learning preference there were 4 hypotheses tested.

Hypothesis	Paths		
H_1	CMLP_Scale	→	Per_Ease_Scale
H_2	Sel_Eff_Scale	→	Per_Ease_Scale
H_3	Sub_Norm_Scale	→	Per_Useful_Scale
H_4	CMLP_Scale	→	Per_Useful_Scale
H_5	Per_Ease_Scale	→	Per_Useful_Scale
H_6	Cog_Need_Scale	→	Lrn_Rel_Scale
H_7	Soc_Need_Scale	→	Lrn_Rel_Scale
H_8	Aff_Need_Scale	→	Lrn_Rel_Scale
H_9	CMLP_Scale	→	Lrn_Rel_Scale
H_{10}	Per_Useful_Scale	→	Lrn_Rel_Scale
H_{11}	Lrn_Rel_Scale	→	Beh_Intention_Scale
H_{12}	CMLP_Scale	→	Beh_Intention_Scale
H_{13}	Per_Useful_Scale	→	Beh_Intention_Scale

Table 5.41 Hypotheses for Testing

Prior to testing these hypotheses, it was necessary to verify the goodness of fit of the structural model. The results of these tests are shown in Table 5.42 below; the Chi Square (χ^2) degree of freedom (*df*) ratio was 4.45 which is above the recommended threshold of 3 as stipulated by Hair et al (2010). However, Hair et al (2010) goes further to suggest that the χ^2: *df* ratio is sensitive to large sample size and complexity of the models being tested. Furthermore, Wheaton et al (1977) opined that ratios of 5 or less in reasonable, therefore, other indices were used to confirm good of fit as well. The results for GFI, TLI, NFI and CFI were all above the recommended value of .90. In addition, the RMR was .044, well below the threshold of .1. So overall, the measurement model demonstrates good fit with the data.

Model Test Statistics	Obtained Values	Recommended Values (Hair et al 2010)	Criteria Met?
(CMIN/ df) ratio	4.45	< 3	No, But due to Large Sample Size
Root Mean Squared Residual (RMR)	0.044	< 0.1	Yes
Root Mean Square Error of Approximation (RMSEA) |90% Confidence Interval|	0.1 |0.078-0.124|	< 0.08	Acceptable as lower boundary < 0.08
Goodness of Fit Index (GFI)	0.961	> 0.9	Yes
Tucker Lewis Index (TLI)	0.919	> 0.9	Yes
Normal Fit Index (NFI)	0.962	> 0.9	Yes
Comparative Fit Index (CFI)	0.970	> 0.9	Yes

Table 5.42 Model Fit Indices for Structural Model

In order to test the significance of the relationships between the constructs in the model, the critical ratio or *t*-value, which is calculated by dividing the regression weight by the standard error, was used at the .05 significance level (see Appendix 7 for regression weights).

The results from the hypothesis testing as shown in Table 5.43 below, revealed that twelve of the thirteen hypotheses were supported as the t-value > ± 1.96. This means that all the relationships in the predicted direction between the latent variables established by the paths in the proposed model are statistically significant, except for H_6 (Cognitive Need → Learning Relevance).

Hypothesis	Paths			Std. Path Coefficient (β)	C.R. (t-value)	P	Support
H_1	CMLP_Scale	→	Per_Ease_Scale	.525	12.194	***	Yes
H_2	Sel_Eff_Scale	→	Per_Ease_Scale	.283	6.570	***	Yes
H_3	Sub_Norm_Scale	→	Per_Useful_Scale	.194	4.938	***	Yes
H_4	CMLP_Scale	→	Per_Useful_Scale	.400	8.115	***	Yes
H_5	Per_Ease_Scale	→	Per_Useful_Scale	.326	7.095	***	Yes
H_6	Cog_Need_Scale	→	Lrn_Rel_Scale	.066	1.665	.096*	No
H_7	Soc_Need_Scale	→	Lrn_Rel_Scale	.082	2.064	.039**	Yes
H_8	Aff_Need_Scale	→	Lrn_Rel_Scale	.159	3.962	***	Yes
H_9	CMLP_Scale	→	Lrn_Rel_Scale	.291	6.097	***	Yes
H_{10}	Per_Useful_Scale	→	Lrn_Rel_Scale	.407	9.193	***	Yes
H_{11}	Lrn_Rel_Scale	→	Beh_Intention_Scale	.116	2.165	.030**	Yes
H_{12}	CMLP_Scale	→	Beh_Intention_Scale	.302	5.895	***	Yes
H_{13}	Per_Useful_Scale	→	Beh_Intention_Scale	.450	8.651	***	Yes

*** P < .001, ** P < .05, * P < .10

Table 5.43 Standardized Path Coefficient and t-values for Structural Model

Turning now to the path analysis, Figure 5.23 below shows the standardized path coefficients (β) and the squared multiple correlations (R^2) for the proposed model.

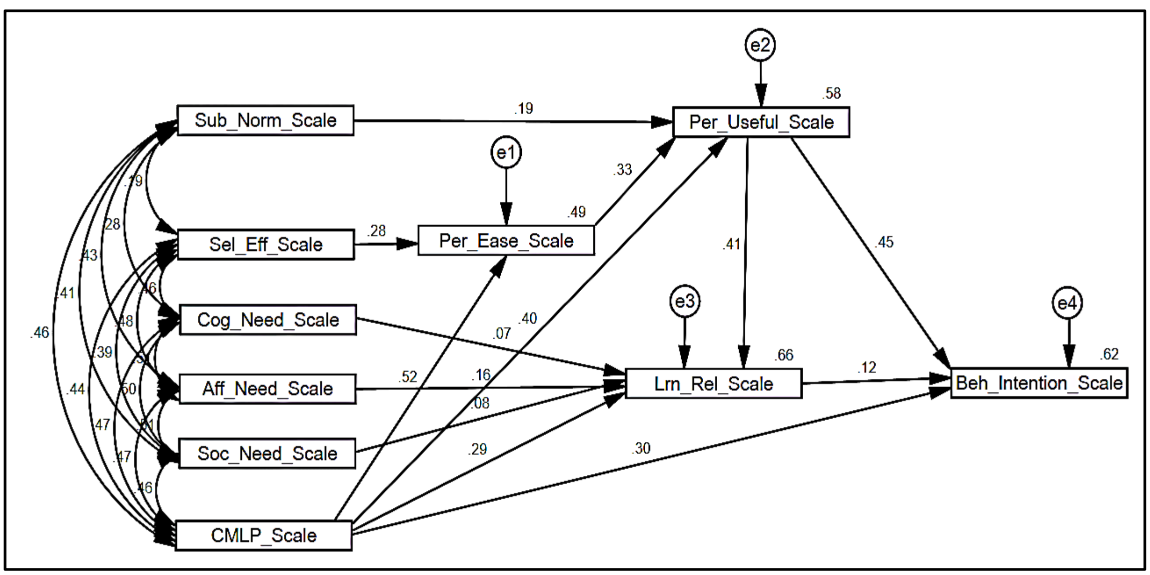

Figure 5.23 Standardized Path Coefficients for Structural Model

The estimate for the squared multiple correlations or coefficient of determination R^2, illustrates the explanatory powers of the exogenous latent variables on the endogenous latent variables. In the proposed model there are four endogenous latent variables for which R^2 estimates were produced (see Appendix 7 for squared multiple correlations).

The results showed that for the endogenous construct of Perceived usefulness, 58% of the variance is explained by the exogenous constructs of subjective norm, perceived ease of use and constructivist mobile learning preference (CMLP). In addition, the exogenous constructs of self-efficacy and CMLP accounts for 49% of the variance in the endogenous construct of perceived ease of use. Furthermore, the exogenous constructs of cognitive need, social need, affective need and CMLP collectively explains 66% of the variance of the endogenous construct learning relevance.

Moreover, the results show in total, the proposed model explains 62% of the variance in the dependent variable behavioural intention to adopt mobile learning, which is accounted for by perceived usefulness, CMLP and learning relevance, in order of contribution.

These findings are consistent with the works of Khanh and Gim (2014) $R^2 = .70$, Hao et al (2017) $R^2 = .59$, Hsia (2016) $R^2 = .57$ and Park et al (2012) $R^2 = .50$, which were all based on TAM. More importantly, the proposed model is further substantiated by the findings of Thongsri et al (2018) whose integrated model of UTAT and UGT, explained 62.6% of the intention to use mobile learning.

5.8 Discussions

This section will provide a discussion of the findings from the structural model. In other words, a closer investigation and analysis will be done on the paths in the proposed model. Therefore, the discussion will be centered around three themes so as to align with the research objectives, that is, motivational factors, pedagogical factors and constructivist mobile learning preference.

5.8.1 Discussion of Finding for Motivational Factors

The discussion in this section relates to research objective 1, that is, to evaluate the motivational factors that influence adult learners to use mobile learning. So, in terms of the **motivational factors**; cognitive, social and affective needs, the path coefficients between cognitive need ($\beta = .07$, $p < .05$), social need ($\beta = .07$, $p < .05$) and learning relevance is low, while the influence of affective need ($\beta = .16$, $p < .05$) on learning relevance is moderate, as defined by Cohen et al (2003).

These results are similar to that of Mondi et al (2008) who found that the effect of cognitive needs on learning experience was not significant, but its effect was a low positive. Further, Mondi et (2008) found that the influence of affective needs was stronger than both cognitive and social needs, this is similar to the findings of this research. Moreover, these findings are also similar to Hashim et al (2014) in that cognitive needs were found to have the lowest effect on attitude to adopt mobile learning, while social needs were stronger than affective.

From these findings, since it is clear that the three motivational constructs of cognitive, social and affective needs have a positive effect on learning relevance albeit low, it suggests that students will be inclined to adopt mobile learning if the collaborative environment is provided and if the students perceive the mobile learning environment to fulfil their emotional needs. However, cognitive needs appear to be a base requirement since it was not found to be significant. Any learning environment must provide learning content, but it is likely that the students are already aware of how to conduct searches and access information from other sources through the use of mobile technology.

The other two motivational factors are subjective norm and self-efficacy, the path coefficients between subjective norm and perceived usefulness ($\beta = .19$, $p < .05$) as well as the path coefficient between self-efficacy and perceived ease of use ($\beta = .28$, $p < .05$) were both positively significant.

These results, with respect to subjective norm, are consistent with those of Park et al (2012) and Hao et al (2017) who both found a positive significant influence on perceived usefulness. These findings are important and can be interpreted such that students will be influenced by their peers and family member to adopt mobile learning, but more importantly by their teachers as well, since it will improve perceived usefulness.

With regards to self-efficacy, the findings contradict those of Chavoshi and Hamidi (2018) who found self-efficacy to have a negative insignificant effect on perceived usefulness. Additionally, this study's findings are consistent with Park et al (2012) in so far as the direction of the effect, that is, positive, but Park et al (2012) found the relationship was insignificant and the path coefficient was lower compared to this study's finding. These findings are interesting since the effect of self-efficacy in this study was greater and significant, meaning that the students in Trinidad have the self-confidence and feel comfortable using mobile technology and they perceived this as being key to a mobile learning environment being useful to their learning goals. This can be explained by the high mobile penetration rate as well as the mobile internet penetration rate in a still developing country (TATT 2019).

5.8.2 Discussion of Findings for Pedagogical Factors

The discussions in this section relates to research objective 2; To evaluate the pedagogical factors that influence behavioural intention of adult learners to use mobile learning. There are three pedagogical factors that were investigated in this research, resulting in four hypothesized paths.

Firstly, the path coefficient between perceived ease of use and perceived usefulness (β = .326, $p < .05$) was found to be moderate and the relationship is significantly positive. In other words, students' perception of the usefulness of mobile learning is significantly influenced by perceived ease of use. This is in keeping with previous findings from Park et al (2012) and Khanh and Gim (2014) who found significant positive influence but with a low effect. Additionally, Joo et al (2016) and Chavoshi and Hamidi (2018) found a strong and moderate effect respectively, but in the case of Joo et al (2016), while the influence was positive it was not significant. This was attributed to the students' characteristics, who live in an advance ICT society (Joo et al 2016). Overall the findings, imply that when mobile learning is perceived to be easy to use and learn, the students' perception of its usefulness towards improving their academic performance will be enhanced.

Secondly, in terms of the influence of perceived usefulness on learning relevance ($\beta = .407, p < .05$) and behavioural intention to adopt ($\beta = .450, p < .05$), the findings indicate a significant positive influence of the moderate effect. Taking the later relationship, the finding is consistent not only with the original TAM, but also with research into mobile learning adoption. For instance, Wang et al (2009), Park et al (2012), Khanh and Gim (2014), Hao et al (2017), Joo et al (2016), Chavoshi and Hamidi (2018) and Hsia (2016) all found a significant positive relationship ranging from low to strong direct effect, with the exception of Park et al (2012) who found the relationship to be insignificant, through perceived ease of use as a mediator, the indirect effect was significant. So overall, this study's finding is in keeping with the existing literature. This means that there is support for the notion that behavioural intention to adopt mobile learning will increase once students perceive mobile learning useful in assisting them to achieve their academic outcome.

With respect to the relationship between perceived usefulness and learning relevance, the finding is consistent with Park et al (2012) and Khanh and Gim (2014) who both found significantly strong positive effects. So overall, these findings have found support in the original TAM as they reinforce its key propositions.

The last relationship within the pedagogical factors is concerned with learning relevance and behavioural intentions ($\beta = .116, p < .05$), which was found to be significantly positive with a low effect. There is no surprise, that this finding is consistent with TAM and the works of Park et al (2012) and Khanh and Gim (2014) whose research confirm the same, however their path coefficients were larger than this study, that is they found moderate effect. This suggest that if students form a favourable attitude towards using mobile learning in terms of relevance to their leaning needs, they will have higher intentions to adopt.

5.8.3 Discussion of Findings for Constructivist Mobile Learning Preference (CMLP)

The discussions in this section relates to research objective 3; to explore the mobile learning preferences of adult learners based on constructivist learning. There are four hypothesized relationship involving CMLP and the pedagogical factors of learning relevance, perceived ease of use and perceived usefulness, based on the proposed model for mobile learning adoption.

The most significant effect involving CMLP was in relation to perceived ease of use ($\beta = .520$, $p < .05$). This can be interpreted to mean that perceived ease of use of the mobile learning environment will improve significantly provided that it is designed to meet the constructivist learning needs of students. This is interesting, as the literature suggest that technology enhanced learning should be driven by the fundamentals of constructivism (Tsai et al 2012. Lai et al 2016). More so in light of support from Cruz et al (2014) who found that learning styles, based on Kolb's learning style inventory, significantly moderated the effect of effort expectancy (same as perceived ease of use) on behavioural intention. This finding is key to adoption because as discussed earlier, perceived ease of use has a significant positive effect on perceived usefulness which then has a significant positive effect on behavioural intention.

In addition, there is a significant positive direct relationship as well between CMLP and perceived usefulness ($\beta = .400$, $p < .05$) and learning relevance ($\beta = .291$, $p < .05$). These relationships are moderate in nature, so as students' expectations for a constructivist mobile learning environment is being satisfied, the learning relevance and perceived usefulness of mobile learning will also increase. But this finding contradicts the work of Cruz et al (2014) who found that learning style does not moderate performance expectancy (same as perceived usefulness) and behavioural intention.

Perhaps the most important and direct relationship regarding CMLP is that with behavioural intention. The results found a significantly positive path coefficient of (β = .302, $p < .05$), which suggest a moderate positive effect. This is similar to Karimi (2016), who found that the learning styles of assimilating and accommodating (Kolb's learning style inventory) resulted in a significant positive effect on mobile learning adoption in both a formal and informal learning context.

In essence, the interpretation sheds light on the necessity for the mobile learning environment to be designed on constructivist principles as it will have a significant effect not only on adoption but actual usage.

5.8.4 Discussion of Total Effects on Behavioural Intentions

In addition, to the discussions above on the direct effects, it is also worthwhile to look at the indirect effects of the exogenous variables on the main endogenous variable in the model, that is, behavioural intention. This is meaningful so as to obtain a full picture of the extent which the individual motivational, pedagogical factors and constructivist mobile learning preference influence behavioural intention, which is at the heart of the research objectives.

The direct, indirect effects and total effect of each unique independent variable of the research has on the dependent variable behavioural intention is show in Table 5.44 below. The influence of the independent variables on behavioural intention are listed in descending order by total effect.

Paths			Direct Path Effect (β)	Indirect Path Effect (β)	Total Effect (β)
Independent		**Dependent**			
CMLP_Scale	→	Beh_Intention_Scale	.302	.317	.619
Per_Useful_Scale	→	Beh_Intention_Scale	.450	.047	.497
Per_Ease_Scale	→	Beh_Intention_Scale	-	.162	.162
Lrn_Rel_Scale	→	Beh_Intention_Scale	.116	-	.116
Sub_Norm_Scale	→	Beh_Intention_Scale	-	.096	.096
Sel_Eff_Scale	→	Beh_Intention_Scale	-	.046	.046
Aff_Need_Scale	→	Beh_Intention_Scale	-	.018	.018
Soc_Need_Scale	→	Beh_Intention_Scale	-	.009	.009
Cog_Need_Scale	→	Beh_Intention_Scale	-	.008	.008

Table 5.44 Total Effects of Independent variables have on Behavioural Intentions

Looking at the indirect effects first for the exogenous latent variables in the model, cognitive needs, social needs and affective needs all have a low positive indirect effect on behavioural intentions since $\beta < .1$. It must be noted that the indirect effect of cognitive need is not significant, since all the indirect effect component path coefficients were not significant (Kline 2011). However, the others, social and affective needs are significant.

These findings are similar to Hashim et al (2014) who found moderate levels of indirect effects for cognitive, social and affective needs on behavioural intentions. Similarly, Thongsri et al (2018) found cognitive, social and affective needs to have a moderate positive significant effect on behavioural intention. This means there is support for these needs as predictors of behavioural intentions to adopt mobile learning.

Subjective norm (β = .096) and self-efficacy (β = .046) also had a low positive indirect effect on behavioural intentions, this is similar to Park et al (2012), Chavoshi and Hamidi (2018) and Hao et al (2017) who all found that subjective norm and self-efficacy have low indirect influence on behavioural intentions.

The final indirect effect is that of the perceived ease of use (β = .162), perceive usefulness (β = .047) and CMLP (β = .317) on behavioural intention, which is significant. This finding is similar to Khanh and Gim (2014), Hsia (2016) and Park et al (2012) findings as well with respect to perceived ease of use.

So overall, CMLP was shown to have the strongest total effect on behavioural intention to adopt mobile learning, followed by the pedagogical factors and the motivational factors.

5.9 Chapter Summary

This chapter presented the results and findings from the data analysis conducted on the nine independent variables and the dependent variable using both descriptive and inferential statistics as well as structural equation modelling. The findings were interpreted by using literature from similar research; therefore, the following chapter will focus on drawing conclusions from these findings and advancing appropriate implications to practice.

CHAPTER 6 CONCLUSIONS AND CONTRIBUTION TO KNOWLEDGE

6.0 Introduction

The main purpose of this study was to develop a framework for mobile learning adoption that would optimize the convergence of mobile technology and pedagogy which would enhance the learning experience of learners. In order to achieve this and answer the research question, the aim was further decomposed into a set of research objectives as follows:

1. To evaluate the motivational factors that influence behavioural intention of adult learners to use mobile learning.
2. To evaluate the pedagogical factors that influence behavioural intention of adult learners to use mobile learning.
3. To explore the mobile learning preference of adult learners towards constructivist learning.

The data needed to facilitate the achievement of these objectives was obtained through the use of an online questionnaire administered to students (n = 345) that voluntarily participated in an action research project, SL2G. The data was analysed using both descriptive and inferential parametric statistical analyses as well as structural equation modelling to evaluate the relationship among the constructs.

It is also important to note that these findings and conclusions drawn as well as subsequent recommendations are relevant in the context of adult learners who were enrolled as part time learners at a private higher education institution in Trinidad. The demographic profile of students that took part in the research were majority female (58%), with most of the participants between the ages of 25-54 (90%) and were either engaged in full time employment (85%), part time employment (3%) or self-employed (6%). In addition, the majority students spend 1 to 4 hours daily (82%) on learning activities regardless of their employment status and the most popular mobile devices were laptops (98%) and smartphones (97%) which was most frequently used at home (47%) and work (40%).

6.1 Conclusions

Based on the findings and discussions presented in the previous chapter, the research will now draw conclusions in relation to the research objectives.

6.1.1 Motivational factors that influence behavioural intention

This study has shown that learners' motivation plays an important role in predicting intention to adopt mobile learning. The study evaluated five motivational scales, cognitive need, social need, affective need drawn from UGT and self-efficacy and subjective norm drawn from TAM.

The results of this investigation showed that the mean score for these scales were moderate to high, this suggest that students perceive mobile learning as having the potential to fulfil their motivational needs. Further investigation into differences by gender, age and job status concludes that there is no difference in these predictors of mobile learning adoption, except with self-efficacy regarding age. The study has identified that the age group 55+ have a lower level of self-efficacy than students in the younger age groups.

The study has also found that generally, the motivational factors have a statistically moderate positive correlation with behavioural intention to adopt mobile learning. Further investigation to the effects of the relationship were conducted using structural equation modelling.

The path analysis and hypothesis testing revealed that the three motivational constructs of cognitive, social and affective needs have a positive effect on learning relevance albeit low, the relationship is also significant, except for the influence of cognitive need on learning relevance. The study also identified that relationships between subjective norm and perceived usefulness as well as between self-efficacy and perceived ease of use were both positively significant.

In summary, these constructs all have indirect effects on behavioural intentions, with cognitive needs ($\beta = .008$), social needs ($\beta = .009$), affective needs ($\beta = .018$), self-efficacy ($\beta = .046$) and subjective norm ($\beta = .096$). It can therefore be concluded that in general, the motivational factors as predictors of behavioural intention to adopt mobile learning has a low positive effect.

6.1.2 Pedagogical factors that influence behavioural intention

The study reveals that pedagogical factors for mobile learning adoption are significant predictors. The research evaluated three pedagogical factors derived from the TAM and were contextualized for mobile learning.

The results showed that the mean score of these scales were high indicating that students perceive mobile learning to be useful and easy to use and their attitude toward mobile learning was favourable. The study concludes that there is a difference in perception with regards to perceived ease of use by gender. It can be concluded that female students reported a perception of ease of use that their male counterparts. It can also be concluded that there is no difference in learning relevance and perceived usefulness by gender.

The results also revealed that there is no difference in terms of age groups and job status for learning relevance, perceived usefulness and perceived ease of use.

The study has also found that generally, the pedagogical factors have a statistically moderate to high positive correlation with behavioural intention to adopt mobile learning. Further investigation to the effects of the relationship were conducted using structural equation modelling.

The path analysis and hypothesis testing found that the relationship between perceived ease of use and perceived usefulness was moderate and the relationship is significantly positive. In other words, it can be concluded that students' perception of the usefulness of mobile learning is significantly influenced by perceived ease of use.

In terms of the influence of perceived usefulness on learning relevance and behavioural intention to adopt, the findings indicate a significant positive influence with moderate effect. Therefore, it can be concluded that perceived usefulness has the ability to positively influence learning relevance and behavioural intention.

The last relationship within the pedagogical factors is concerned with learning relevance and behavioural intentions, which was found to be significantly positive with a low effect.

Further analysis revealed that perceived ease of use and perceive usefulness indirect effect on behavioural intention, was also significant and positively related. Therefore, the total effect of perceived ease of use (β = .162) on behavioural intention was low, likewise learning relevance (β = .116), but it can now be concluded that of the pedagogical factors, perceive usefulness (β = .497) has the strongest positive effect on behavioural intentions to adopt mobile learning,

6.1.3 Mobile learning preference towards constructivist learning

The study evaluated students' preference for a constructivist mobile learning environment by developing a measurement that consisted on five scales, namely continuity, timely guidance, adaptive content, inquiry learning and student negotiation.

The results of the mean score on these scales showed that students have a high preference for these constructivist features. It can be concluded that the predominant differences in these scales lie with continuity, that is, the results showed a significant difference with all the other CMLP scales with the exception of timely guidance.

Therefore, conclusions can be drawn that the highest priority preference to consider when designing a mobile learning environment is student negotiation followed by inquiry learning, adaptive content, timely guidance, and lowest preference for continuity of learning. It can also be concluded that there are no significant differences in these scales by gender, age and job status.

The study has found that generally, students prefer a student-centered approach when using a mobile learning environment, this is can be confirmed since the majority of learners prefer a student-centered environment (80.3%) compared to teacher-centered preference (19.7%).

The results also reveal a statistically significant difference in behavioral intentions between the polar extremes of the CMLP scale, that is, student centered and teacher centered strategies. Therefore, it can be concluded that only 4% of students who prefer the teacher centered approach will have a high intention to adopt mobile learning compared to the 63% of students that have high intentions to adopt because they prefer a student centered approach. It can also be concluded that there is a strong positive relationship between behavioural intention and CMLP ($r=.698$, $p < .01$).

The results from the path analysis revealed that the most significant effect involving CMLP was in relation to perceived ease of use ($\beta = .520$). In addition, there is a significant positive direct relationship as well between CMLP and perceived usefulness ($\beta = .400$) and learning relevance ($\beta = .291$). The study found that CMLP total effect on behavioural intention is strong ($\beta = .619$).

6.1.4 Summary of main conclusions

In summary, there are several key conclusions to be drawn from the research. Firstly, 66% of the students demonstrated high behavioural intention towards mobile learning. The study found no differences in behavioural intention with regards to gender, age and job status. However, there were two differences unearthed with respect to the predictors, that is, older students showed less self-efficacy than the younger students and male students' perceived ease of use was lower than female students.

Secondly, the study revealed that of the students who preferred the student centered approach the majority have high intentions to adopt compared to students who prefer the teacher centered approach. Nevertheless, preference for the teacher centered group accounted for 20% of the students.

Thirdly, the correlation between behavioural intentions and its independent variables were found to be positively moderate to strong. The results of the investigation into the total effects of the each of the independent variable on behavioural intentions revealed that CMLP was shown to have the strongest total effect, followed by the pedagogical factors and the motivational factors.

6.2 Proposed Model for Mobile Learning Adoption

The key findings from the research show support for TAM, UGT and constructivist mobile learning preference. Therefore, the proposed theoretical model for mobile learning adoption integrates the key concepts from TAM, UGT and the constructivist theory of learning. More importantly, the proposed model for mobile learning adoption advances a more complete and integrated view from a teaching and learning context as the constructs included, addressed the core issues of technology enhanced pedagogy and motivation of learners to adopt.

Overall, the proposed theoretical model explained a significant amount, 62% of the variance in learners' intention to adopt mobile learning. Hence, the model's explanatory power for behavioural intention to adopt mobile learning is strong and further endorses that the model fits the data. In other words, the independent variables included in this research, which were categorized as motivational and pedagogical factors, are appropriate for explaining the variance in learners' intention to adopt mobile learning.

Based on the SEM, all the hypotheses were supported, where 12 of the 13 hypotheses were supported at a significant level of 0.001 and 1 of the hypotheses was supported at a significant level of 0.1. Therefore, the paths in the derived structural model were significant and thus offers meaningful explanations for students' intention to adopt mobile learning. In others words, the model indicates that students have a strong intention to adopt mobile learning when their motivational and pedagogical needs are fulfilled and the learning environment is based on a constructivist design. Moreover, institutions and educators must pay attention to these factors when deciding to implement a mobile learning environment. Therefore, the research advances the tested structural model as a suitable theoretical model for mobile learning adoption as shown in Figure 6.1 below.

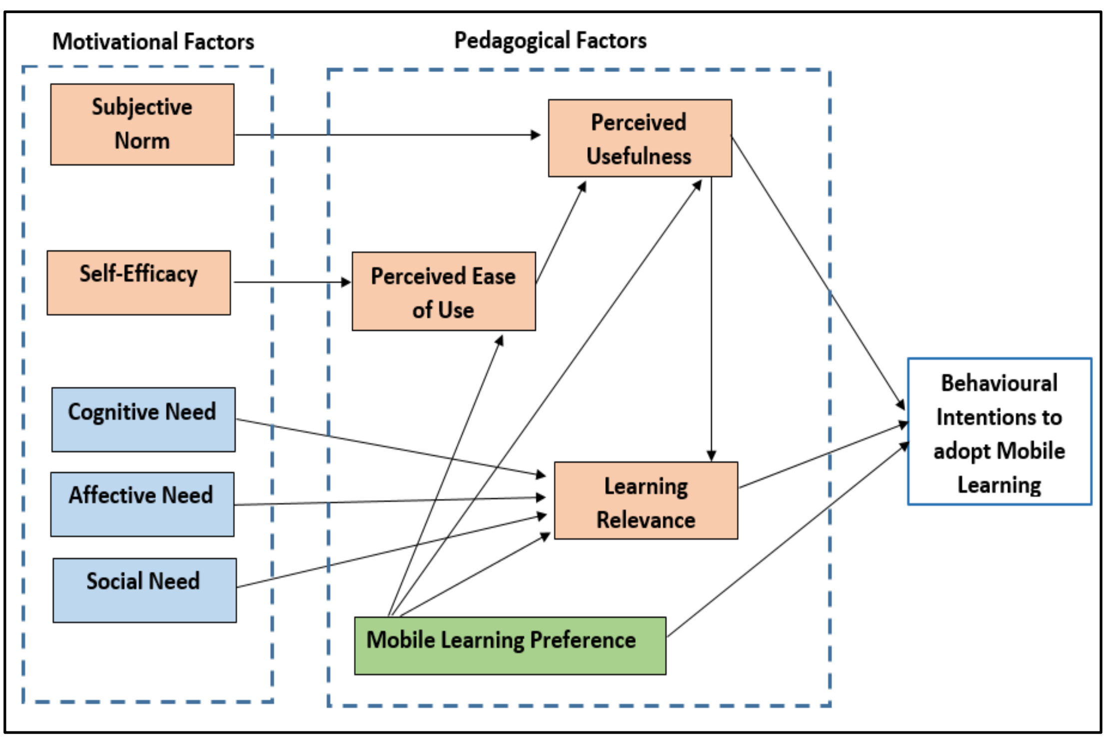

Figure 6.1 Proposed Theoretical Model for Mobile Learning Adoption

6.3 Recommendations and Implications to Practice

In light of the conclusion and proposed model above, this section will now submit recommendations and discuss the implications to practice so as to postulate appropriate answers to the research question: **how can the adoption of Mobile Learning be used to augment the pedagogical strategies currently used for adult learners in the private higher education sector in Trinidad?**

The recommendations and implication to practice will encompass two sections; firstly, the propositions on an appropriate mobile learning strategy and secondly, propositions on an appropriate teaching and learning strategy for a mobile learning environment.

6.3.1 Mobile Learning Adoption Strategy

The first issue that the recommendations must address in relation to the research question is that of mobile learning adoption strategy. Based on the findings that the motivational and pedagogical factors have a significant positive influence mobile learning adoption. Institutions and educators must recognize that these factors are important to enriching the overall student experience from using mobile learning. As such, it is vitally important that the educators designing the mobile learning environment do so in light of this study's findings, so as to ensure that students have an enlightening learning experience and are motivated to engage with the mobile learning environment.

The researcher proposes the two step model for mobile learning adoption as shown in Figure 6.2 below. The model was derived by using the output of the SEM analysis, that is, each adoption factor was ranked based on the total effect on behavioural intention. It must be noted that the effects of all the independent variables showed a statistically significant positive effect on behavioural intention.

Overall, the motivational factors portrayed a lower rank over the pedagogical factors and constructivist learning preference, consequently, institutions and educators should be cognisant that adoption should start with the motivational step then move onto the pedagogical step.

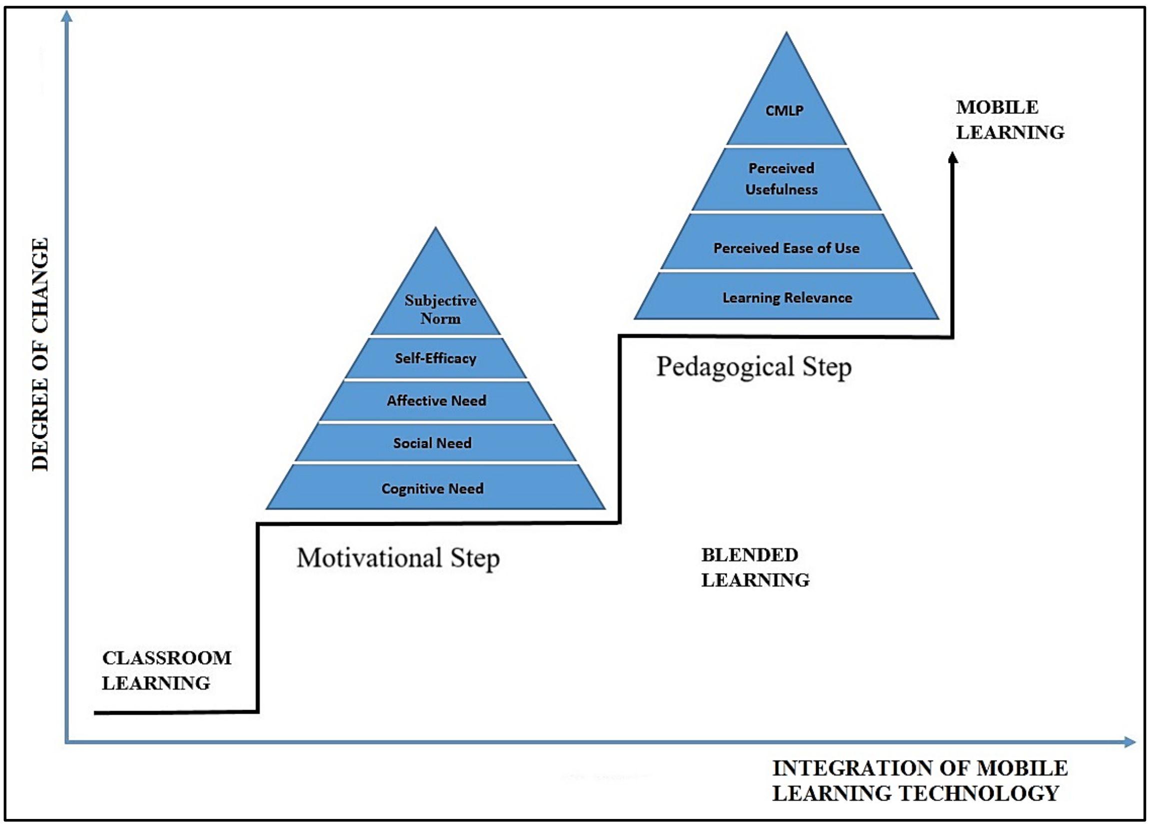

Figure 6.2 The 2 Step Model for Mobile Learning Adoption

Specifically, within the motivational step cognitive needs created the lowest effect followed by social needs, affective needs, self-efficacy and the strongest motivational factor that of subjective norm. Overall, these effects were relatively low compared to the pedagogical factors. Nevertheless, there were found to be significantly positively related to behavioural intentions.

Within the pedagogical step, the least effect came from learning relevance followed by perceived ease of use, perceived usefulness and constructivist mobile learning preference (CMLP) capped it off with the highest effect on behavioural intention.

The implications in terms of the motivational steps mean that institutions and educators should provide an avenue to learners to search for information that meet their needs and access learning material, this will facilitate fulfilment of their cognitive needs. In regards to social needs, the mobile learning environment should be collaborative to allow for students to interact, share views on topics and participate in asking and answering questions directed to or from their peers and teachers. In terms of affective needs, the mobile learning environment must be capable of creating a fulfilling experience through activities that allows the learner to make innovative use of their mobile device.

In addition, the learning environment should be designed so as to give learners' confidence in their usage. Institutions should provide both technical and managerial support to students as a means of bolstering student confidence. Lastly, in terms of subjective norm, institutions should also provide encouragement through their faculty and provide a forum that allow students to share their experience of usage with their fellow students.

Furthermore, the implications with respect to the pedagogical step, mean that institutions and educators should provide content that will allow the learners to accomplish learning outcomes through assessments, develop their study skill and more importantly improve their academic performance. In addition, the mobile learning environment should be easy to learn in terms of use and allow the learner to become skillful quickly as well to allow the user to customize their interface. Further, the mobile learning environment should facilitate learners to carry out their learning activities easily.

6.3.2 Teaching and Learning Strategy

The second issue to be addressed in the research question involves the change in pedagogy needed. Educators must also consider the implications for the teaching and learning strategy when implementing mobile learning as the research has shown that it has a significant effect on adoption. Therefore, consideration must be given to the types of learners that will adopt mobile learning so as to inform instructional design.

The researcher therefore advances, based on the findings, that there are four types of learners that will use a mobile learning environment. As such, the researcher proposes the Typology of Mobile Learners model shown in Figure 6.3 below. The model was generated based on the constructivist mobile learning preference scale and the behavioural intention scale, given that both correlation analysis and structural equation modelling provides evidence of a statistically significantly good positive relationship.

The model is therefore based on two continuums. The horizontal continuum represents preference for a constructivist mobile learning environment, with two extremes. Students who demonstrated a low preference meant they prefer the teacher centered style of learning, while students who demonstrated a high preference meant they prefer the student centered style of learning.

The vertical continuum represents the degree of behavioural intention to adopt mobile learning. Students who demonstrated a low degree on intention to adopt mobile are categorized as laggards, whereas students who demonstrated a high degree of intention to adopt are categorized as innovators.

The converging of the two continuums results in 4 types of mobile learners:

Passive Knowledge Consumers- these are students who prefer a teacher centered style and have a low intention to adopt mobile learning.

Active Knowledge Consumers- these are students who prefer a teacher centered style and have a high intention to adopt mobile learning.

Passive Knowledge Constructors- these are students who prefer a student centered style and have a low intention to adopt mobile learning.

Active Knowledge Constructors- these are students who prefer a student centered style and have a high intention to adopt mobile learning.

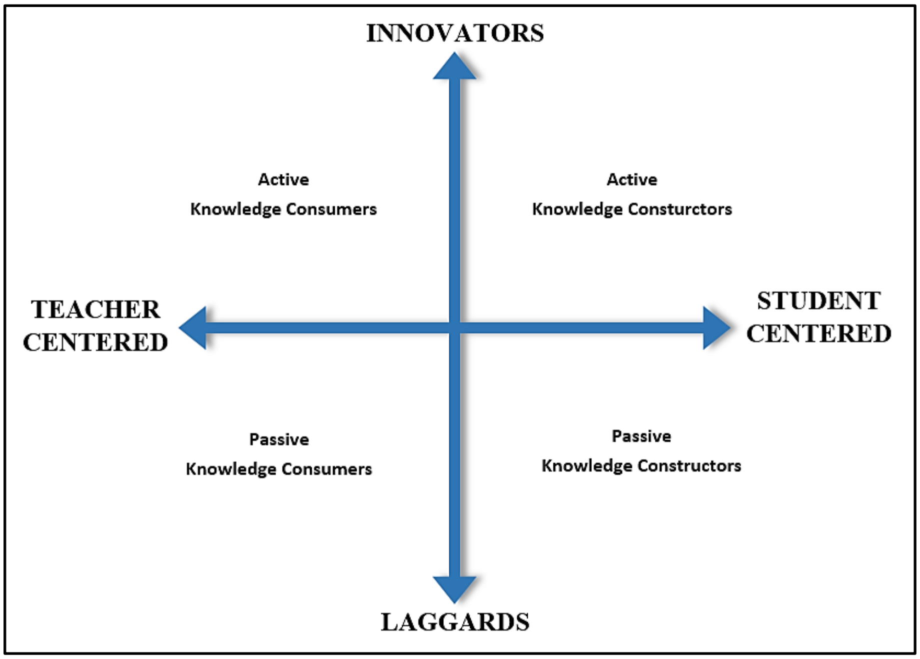

Figure 6.3 Typology of Mobile Learners

The term knowledge consumers here refer to students who are characterized as recipients of learning content and prefer to be observers. Whereas knowledge constructors here refer to students who are characterized as producers of knowledge through critical thinking and judgement and are more interested in interaction with other learners.

The term passive refers to learners who are characterized by a low level of engagement with the mobile learning environment. Whereas, the term active refer to learners who are characterized by a high level of engagement with the mobile learning environment.

In addition, from a teaching and learning perspective, the model shows the need to accommodate for the learners who are knowledge consumers or knowledge constructors and in terms of engagement with mobile learning, passive or active users. Interestingly, the research has shown that even though student may not be inclined to a student centered style of learning, that is, constructivist pedagogy, 20% were still willing to adopt mobile learning as either active or passive knowledge consumers.

Furthermore, the research shows that a significant amount of students demonstrated preference for a student centered style of learning and have a high degree of intention to adopt as active knowledge constructors which accounted for 63% of the students, while 17 % were passive knowledge constructors.

Educators, must therefore design a mobile learning environment that accommodates for the typology of mobile learners as they have varying teaching and learning needs. In order to provide insights on this, the researcher makes the following recommendations to augment the current pedagogy in the private higher education sector.

The implication to the teaching and learning strategy is clearly based on the typology of mobile learners, as such the mobile learning environment should be predominantly constructivist but also be capable of accommodating to the minority of learners' who prefer a cognitive approach. Therefore, the implication in terms of constructivist learning should be based mainly on the feature and preferences of timely guidance, student negotiation and inquiry learning, while the implications in terms of cognitive approach should be based on adaptive content and continuity, where these two can be seen as the base of mobile learning environment, that is a platform for the stronger constructivist features.

So, in terms of timely guidance, student negotiation and inquiry learning, educators must develop mobile learning activities that focuses not only on providing support in a timely manner but also on activities that are capable of evaluating students' progress towards the learning outcomes so as to provide feedback and further guidance. In addition, educators should develop mobile learning activities that facilitates knowledge construction through dialogue with the community of learners which encourages leaners to have a voice and recognize the value of multiple views. Moreover, teachers should develop mobile learning activities that encourages problem solving and creative thinking.

Lastly, in terms of adaptive content and continuity, educators should ensure that the learning content is authentic and contextualized to real world problems so that learners can make a connection between theory and practice. Also, educators should ensure that the content is tailored to and relevant to the learners' requirements. They should also provide features that will allow the learners to access the learning content anytime and anywhere. Furthermore, it will be imperative that educators also devise features that will allow the learner to track their progress and understand their learning path.

In closing the researcher recommends that higher education institutions encourage teachers to recognize the need for constructivism in a mobile learning environment through the use of staff development focused on developing mobile learning activities that can meet the needs of learners.

6.4 Contribution to Knowledge

This research contributes to knowledge in two meaningful ways, firstly in terms of mobile learning adoption theory and secondly in terms of education technology as an enabler of the constructivist pedagogy.

This study makes a significant contribution to mobile learning adoption theory by extending the underlying adoption theory of TAM, to include motivational factors, which were not previously addressed. This is significant, as currently there are only a few studies that have investigated motivational factors into behavioural intentions to adopt mobile learning. Most studies on mobile learning adoption focused on the core constructs of TAM and their antecedents. By integrating the motivational aspects, this study adds richness and sheds light on understanding learners' internal motives for adopting mobile learning.

The study also extended the mobile adoption literature by injecting the learners' preference towards a constructivist learning environment as a determinant of behavioural intention to adopt mobile learning. By doing so, the study was able to address gaps in the literature regarding, not only the influence of students learning preference on mobile learning adoption but in exploring the differences in adoption in terms of a constructivist pedagogy.

This led to another substantial contribution to the literature, that is, the study was able to shed light on the learners' preference for a constructivist mobile learning environment. In so doing, the research provided insights into the instructional design, based on a constructivist pedagogy, for a mobile learning environment. In other words, the findings from the research can inform the design of mobile learning activities that can optimize the convergence of mobile technology and pedagogy.

In essence, this study contributes to the field of mobile learning adoption and technology enhanced teaching and learning in the context of a developing country. Given that the study addressed the lack of research on technology adoption in higher education in Trinidad, that is, from a Caribbean context. By extension, the findings of this research can also be applied to higher education institutions in other developing countries with a similar socio-cultural context. The study's theoretical contributions can also be useful to the other qualification levels of the education system, namely the primary and secondary school levels. Furthermore, the proposed model for mobile learning adoption can be applied to fields other than higher education, for instance to investigate consumer adoption of mobile commerce, mobile health, mobile banking and other services that can be transformed through mobile technology.

6.5 Research Limitations and Future Research

Although, the research design emphasized on generalization of findings and the results were found to be significantly statistically reliable and valid. The above conclusions, recommendations, implications to practice as well as the contribution to knowledge must be interpreted within the context of the research and its limitations.

The sample population was not drawn from the national higher education student population to include the public sector higher education institutions. Additionally, the sample did not access students from a wider cross-section of demographic and higher education courses as this would have been difficult due to the use of action research.

However, the impact of this limitation is minimal as the sample size (n = 345) was large enough to ensure a 99% probability (Confidence Level) that the sample represents the population. Moreover, the demographic data from the sample population correspond to the ratios for gender and age to that of the public sector higher education institutions.

Again, another limitation due to the research scope, is that the views of the teachers were not elicited for this research. In essences, their views are just as important as the views of students since they form part of the dialectic relationship needed for the development of a constructivist educational technology pedagogy for a mobile learning environment.

Ultimately, the data used for the research was self-reported from students due to the underlying subjectivist philosophical assumptions of the research and the use of an online questionnaire. However, the impact of this issue was mitigated by using action research so as to enable the students to actually use and experience a mobile learning environment. Additionally, the researcher collected the data from the student just prior to the end of the action phase in each loop. This would have helped to reduce the potential of student's selective memory bias of the experience when responding to the online questionnaire.

The research was also conducted using a cross-sectional design as the cohorts of students that participated in the study were only engage with the action research project for one trimester and therefore, data was collected only once from each cohort. The implication of this limitation is that issues regarding long term use of a mobile learning environment was not factored into the behavioural intention to adopt. These issues include; distraction, smartphone addiction and its effects on academic performance.

In recognition of the above limitations and implications, the following recommendations for future research are proposed. Firstly, further research on mobile learning adoption using students from the wider national level to include public sector institutions and learners from a wider range of demographic and higher education courses, will provide more generalizable findings to all higher education institutions. Additionally, the widening of the population would also lead to additional information suitable for developing mobile learning for a multitude of purposes.

An extension of the above recommendation will be to conduct longitudinal studies on mobile learning adoption, more so on the long term use of mobile learning. Research into this aspect will advance findings on the relationship between mobile learning and smartphone addiction. More interestingly, investigation into the potential for students to get distracted from their learning activities by non-related internet activities such social media, video streaming services and internet television to name a few is a necessity. This is the case since findings into these areas can be used to develop a mobile learning environment that minimize the potential for distractions to reduce student engagement with the learning activities.

The researcher also proposes that studies into teacher's perception and attitude towards mobile learning adoption be conducted. This is especially important as successful implementation of a mobile learning environment will depend largely on their views of the benefits and potential challenges. Additionally, research into the teachers' preference towards a constructivist teaching style is also critical, since in a mobile learning environment, teachers will play a supportive role to the students' learning. Furthermore, unification of the teachers' perception, attitude and teaching style with the students' views of mobile learning will result in institutional development as the findings can be used to advance development of the institution's technology-enhanced teaching and learning strategy.

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Appendices

Appendix 1- Additional Statistics from SPSS

Demographics

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	199	57.7	57.7	57.7
	Male	146	42.3	42.3	100.0
	Total	345	100.0	100.0	

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	345	21	60	36.14	8.586
Valid N (listwise)	345				

Age_Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-24	26	7.5	7.5	7.5
	25-34	129	37.4	37.4	44.9
	35-44	131	38.0	38.0	82.9
	45-54	51	14.8	14.8	97.7
	55+	8	2.3	2.3	100.0
	Total	345	100.0	100.0	

Job Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Full Time Employment	294	85.2	85.2	85.2
	Part Time Employment	10	2.9	2.9	88.1
	Self-employed	22	6.4	6.4	94.5
	Unemployed	19	5.5	5.5	100.0
	Total	345	100.0	100.0	

Hours Spend on Job

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 to 2 Hrs	7	2.0	2.0	2.0
	3 to 4 Hrs	10	2.9	2.9	4.9
	5 to 6 Hrs	39	11.3	11.3	16.2
	7 to 8 Hrs	136	39.4	39.4	55.7
	More than 8Hrs	138	40.0	40.0	95.7
	None	15	4.3	4.3	100.0
	Total	345	100.0	100.0	

Hours Spend on Study

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 to 2 Hrs	132	38.3	38.3	38.3
	3 to 4 Hrs	151	43.8	43.8	82.0
	5 to 6 Hrs	44	12.8	12.8	94.8
	7 to 8 Hrs	5	1.4	1.4	96.2
	More than 8Hrs	8	2.3	2.3	98.6
	None	5	1.4	1.4	100.0
	Total	345	100.0	100.0	

Hours Spend on Family

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 to 2 Hrs	122	35.4	35.4	35.4
	3 to 4 Hrs	131	38.0	38.0	73.3
	5 to 6 Hrs	47	13.6	13.6	87.0
	7 to 8 Hrs	15	4.3	4.3	91.3
	More than 8Hrs	13	3.8	3.8	95.1
	None	17	4.9	4.9	100.0
	Total	345	100.0	100.0	

Hours Spend on Socialization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 to 2 Hrs	197	57.1	57.1	57.1
	3 to 4 Hrs	41	11.9	11.9	69.0
	5 to 6 Hrs	10	2.9	2.9	71.9
	7 to 8 Hrs	4	1.2	1.2	73.0
	More than	1	.3	.3	73.3
	None	92	26.7	26.7	100.0
	Total	345	100.0	100.0	

Smartphone

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	11	3.2	3.2	3.2
	Yes	334	96.8	96.8	100.0
	Total	345	100.0	100.0	

Tablet

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	92	26.7	26.7	26.7
	Yes	253	73.3	73.3	100.0
	Total	345	100.0	100.0	

Laptop

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	8	2.3	2.3	2.3
	Yes	337	97.7	97.7	100.0
	Total	345	100.0	100.0	

Other Devices

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	243	70.4	70.4	70.4
	Yes	102	29.6	29.6	100.0
	Total	345	100.0	100.0	

Number of Devices Owned

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Device	11	3.2	3.2	3.2
	2 Devices	73	21.2	21.2	24.3
	3 Devices	175	50.7	50.7	75.1
	> 3 Devices	86	24.9	24.9	100.0
	Total	345	100.0	100.0	

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Howmuchtimedoyouspendonyourmobiledeviceonadailybasi	345	1	24	5.80	4.156
Valid N (listwise)	345				

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Time Spent on Mobile Device	Male	146	5.71	4.189	.347
	Female	199	5.86	4.141	.294

Independent Samples Test

		Levene's Test for Equality of Variances				
		F	Sig.	t	df	Sig. (2-tailed)
Time Spent on Mobile Device	Equal variances assumed	.308	.580	-.350	343	.726
	Equal variances not assumed			-.350	310.554	.727

Wheredoyouuseyourmobiledevicemostfrequently

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	At Home	163	47.2	47.2	47.2
	At School	2	.6	.6	47.8
	At Work	137	39.7	39.7	87.5
	Socialising/Relaxation	17	4.9	4.9	92.5
	While Commuting/Travelling	26	7.5	7.5	100.0
	Total	345	100.0	100.0	

Mobile Device Central part of Everday

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	12	3.5	3.5	3.5
	Disagree	5	1.4	1.4	4.9
	Neutral	33	9.6	9.6	14.5
	Agree	79	22.9	22.9	37.4
	Strongly Agree	216	62.6	62.6	100.0
	Total	345	100.0	100.0	

$Mobile_Usage_Activities Frequencies

		Responses		Percent of Cases
		N	Percent	
Mobile Usage Activities[a]	Social Media	259	10.4%	75.1%
	Reading Content	282	11.3%	81.7%
	Accessing Email	333	13.4%	96.5%
	Messaging	339	13.6%	98.3%
	Searching for Information	324	13.0%	93.9%
	Getting News Alert	234	9.4%	67.8%
	Playing Games	109	4.4%	31.6%
	Listening to Music	228	9.2%	66.1%
	Record Videos, Take Photos	226	9.1%	65.5%
	Purchase Products or Services	153	6.2%	44.3%
Total		2487	100.0%	720.9%

a. Dichotomy group tabulated at value 1.

Gender * Social Media

Crosstab

Count

		Social Media: No	Social Media: Yes	Total
Gender	Male	45	101	146
	Female	41	158	199
Total		86	259	345

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.699[a]	1	.030
Continuity Correction[b]	4.169	1	.041
Likelihood Ratio	4.659	1	.031
Fisher's Exact Test			
Linear-by-Linear Association	4.686	1	.030
N of Valid Cases	345		

Gender * Record Videos, Take Photos

Crosstab

Count

		Record Videos, Take Photos: No	Record Videos, Take Photos: Yes	Total
Gender	Male	64	82	146
	Female	55	144	199
Total		119	226	345

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.778[a]	1	.002
Continuity Correction[b]	9.075	1	.003
Likelihood Ratio	9.736	1	.002
Fisher's Exact Test			
Linear-by-Linear Association	9.750	1	.002
N of Valid Cases	345		

Age_Group * Social Media

Crosstab

Count

		Social Media		
		No	Yes	Total
Age_Group	21-24	2	24	26
	25-34	27	102	129
	35-44	35	96	131
	45-54	19	32	51
	55+	3	5	8
Total		86	259	345

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.270[a]	4	.036
Likelihood Ratio	10.989	4	.027
Linear-by-Linear Association	9.620	1	.002
N of Valid Cases	345		

Job Status * Accessing Email

Crosstab

Count

		Accessing Email		
		No	Yes	Total
Job Status	Full Time Employment	9	285	294
	Part Time Employment	2	8	10
	Self Employed	0	22	22
	Unemployed	1	18	19
Total		12	333	345

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.256[a]	3	.026
Likelihood Ratio	5.866	3	.118
Linear-by-Linear Association	.165	1	.684
N of Valid Cases	345		

$Mobile_Learning_Usage Frequencies

		Responses N	Responses Percent	Percent of Cases
Mobile Learning Usage[a]	Search for terms used by lecturer you did not understand	266	13.9%	78.9%
	Take pictures of lectuer's notes	186	9.8%	55.2%
	audio/video the lecturer's guidelines	140	7.3%	41.5%
	Read articles about the topic being taught	243	12.7%	72.1%
	Message fello students about a topic or assignment	246	12.9%	73.0%
	Access your University VLE	212	11.1%	62.9%
	Download lecture notes	256	13.4%	76.0%
	Take part in class forums and blogs	128	6.7%	38.0%
	Schedule important deadlines in your calendar	230	12.1%	68.2%
Total		1907	100.0%	565.9%

a. Dichotomy group tabulated at value 1.

Gender * Message fello students about a topic or assignment Crosstabulation

			Message fello students about a topic or assignment: No	Yes	Total
Gender	Male	Count	53	93	146
		% within Gender	36.3%	63.7%	100.0%
	Female	Count	46	153	199
		% within Gender	23.1%	76.9%	100.0%
Total		Count	99	246	345
		% within Gender	28.7%	71.3%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.156[a]	1	.007		
Continuity Correction[b]	6.526	1	.011		
Likelihood Ratio	7.104	1	.008		
Fisher's Exact Test				.008	.005
Linear-by-Linear Association	7.135	1	.008		
N of Valid Cases	345				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 41.90.

Mobile Device Central part of Everday					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	12	3.5	3.5	3.5
	Disagree	5	1.4	1.4	4.9
	Neutral	33	9.6	9.6	14.5
	Agree	79	22.9	22.9	37.4
	Strongly Agree	216	62.6	62.6	100.0
	Total	345	100.0	100.0	

Summary of means score for Motivational Subscales.

Descriptive Statistics			
	N	Mean	Std. Deviation
Cog_Need_Scale	345	4.0763	.94877
Aff_Need_Scale	345	3.5449	.91921
Soc_Need_Scale	345	3.7440	.94545
Sel_Eff_Scale	345	3.9121	.86584
Sub_Norm_Scale	345	3.4126	1.03656
Valid N (listwise)	345		

Difference by Gender- Motivational Factors

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Cog_Need_Scale	Male	146	3.9932	1.05006	.08690
	Female	199	4.1374	.86463	.06129
Aff_Need_Scale	Male	146	3.5594	.97237	.08047
	Female	199	3.5343	.88053	.06242
Soc_Need_Scale	Male	146	3.6553	.98760	.08173
	Female	199	3.8090	.91031	.06453
Sel_Eff_Scale	Male	146	3.8744	.93065	.07702
	Female	199	3.9397	.81632	.05787
Sub_Norm_Scale	Male	146	3.4795	1.02383	.08473
	Female	199	3.3635	1.04564	.07412

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Cog_Need_Scale	Equal variances assumed	2.705	.101	-1.397	343	.163
	Equal variances not assumed			-1.356	275.256	.176
Aff_Need_Scale	Equal variances assumed	1.681	.196	.249	343	.803
	Equal variances not assumed			.246	294.020	.806
Soc_Need_Scale	Equal variances assumed	.413	.521	-1.495	343	.136
	Equal variances not assumed			-1.477	297.465	.141
Sel_Eff_Scale	Equal variances assumed	4.853	.028	-.691	343	.490
	Equal variances not assumed			-.678	287.754	.499
Sub_Norm_Scale	Equal variances assumed	.153	.696	1.027	343	.305
	Equal variances not assumed			1.030	316.223	.304

Difference by Age groups- Motivational Factors

Post Hoc Test Age group and Motivational Factors- Self Efficacy

Multiple Comparisons

Scheffe

Dependent Variable	(I) Age_Group	(J) Age_Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Sel_Eff_Scale	21-24	25-34	-.0231	.18393	1.000	-.5927	.5466
		35-44	.0329	.18370	1.000	-.5361	.6018
		45-54	.2489	.20618	.834	-.3897	.8875
		55+	.9327	.34592	.125	-.1387	2.0041
	25-34	21-24	.0231	.18393	1.000	-.5466	.5927
		35-44	.0559	.10613	.991	-.2728	.3846
		45-54	.2719	.14152	.451	-.1664	.7103
		55+	.9557	.31174	.054	-.0098	1.9213
	35-44	21-24	-.0329	.18370	1.000	-.6018	.5361
		25-34	-.0559	.10613	.991	-.3846	.2728
		45-54	.2160	.14122	.674	-.2214	.6534
		55+	.8998	.31160	.082	-.0653	1.8649
	45-54	21-24	-.2489	.20618	.834	-.8875	.3897
		25-34	-.2719	.14152	.451	-.7103	.1664
		35-44	-.2160	.14122	.674	-.6534	.2214
		55+	.6838	.32536	.354	-.3239	1.6915
	55+	21-24	-.9327	.34592	.125	-2.0041	.1387
		25-34	-.9557	.31174	.054	-1.9213	.0098
		35-44	-.8998	.31160	.082	-1.8649	.0653
		45-54	-.6838	.32536	.354	-1.6915	.3239

Summary of mean scores for Pedagogical Factors

Descriptive Statistics

	N	Mean	Std. Deviation
Lrn_Rel_Scale	345	4.0348	.90438
Per_Useful_Scale	345	3.9130	.91013
Per_Ease_Scale	345	3.9304	.88283
Valid N (listwise)	345		

Difference by Gender- Pedagogical Factors

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Lrn_Rel_Scale	Male	146	3.9406	.92366	.07644
	Female	199	4.1039	.88594	.06280
Per_Ease_Scale	Male	146	3.8059	.90275	.07471
	Female	199	4.0218	.85875	.06088
Per_Useful_Scale	Male	146	3.8836	.88547	.07328
	Female	199	3.9347	.92943	.06589

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Lrn_Rel_Scale	Equal variances assumed	.338	.562	-1.660	343	.098
	Equal variances not assumed			-1.650	305.031	.100
Per_Ease_Scale	Equal variances assumed	.866	.353	-2.257	343	.025
	Equal variances not assumed			-2.240	303.483	.026
Per_Useful_Scale	Equal variances assumed	.011	.918	-.515	343	.607
	Equal variances not assumed			-.519	320.703	.604

Behavioural Intention Score by CMLP Category

Case Summaries

Mean

CMLP_Category	Beh_Intention_Scale
Teacher-Centered	2.8627
Student-Centered	4.0722
Total	3.8338

Difference by Gender CMLP

Independent Samples Test

		Levene's Test for Equality of Variances				
		F	Sig.	t	df	Sig. (2-tailed)
CMLP_CO	Equal variances assumed	.092	.762	-.828	343	.408
	Equal variances not assumed			-.833	319.355	.405
CMLP_TG	Equal variances assumed	.066	.797	-1.349	343	.178
	Equal variances not assumed			-1.343	307.713	.180
CMLP_AC	Equal variances assumed	.084	.772	-1.104	343	.270
	Equal variances not assumed			-1.097	305.197	.273
CMLP_IL	Equal variances assumed	.106	.745	-1.393	343	.165
	Equal variances not assumed			-1.388	309.020	.166
CMLP_SN	Equal variances assumed	.117	.733	-.618	343	.537
	Equal variances not assumed			-.620	315.643	.536
CMLP_SM	Equal variances assumed	.135	.714	-1.381	343	.168
	Equal variances not			-1.386	317.012	.167

Mobile Learning Adoption Questionnaire

Welcome. You are invited to take part in this survey, it should not take more than 10 mins to be completed.
For further details on the Survey and the Participant Information Sheet please go to:
http://www.samuellearning.org/dba.html
For a live experience of using mobile learning go to: http://mobile.samuellearning.org

* Required

1. **Having read and understood the details in Participant Information Sheet, Do you agree to take part in this survey** *
   Mark only one oval.

   - Yes *Skip to question 2.*
   - No *Stop filling out this form.*

Section 1 Demographics

What is your Gender? *
Mark only one oval.

- Male
- Female

What is your Age? *
please enter your age as a number

____

What is your Job Status? *
Mark only one oval.

- Full Time Employment
- Part Time Employment
- Self-employed
- Unemployed
- Other: ______________________

How many hours per day do you spend on the following? *

Give an average

Mark only one oval per row.

	None	1 to 2 Hrs	3 to 4 Hrs	5 to 6 Hrs	7 to 8 Hrs	More than 8Hrs
Job/Work						
School/Studying						
Family						
Socializing						

Section 2 Mobile Usage

Which of the following Internet enabled mobile device do you own? *

Mark only one oval per row.

	Yes	No
Smart Phone		
Tablet		
Laptop		
Other Mobile Devices		

How much time do you spend on your mobile device on a daily basis? *

Please state Number of Hours

Where do you use your mobile device most frequently? *

Choose one Option

Mark only one oval.

- At Home
- At Work
- While Commuting/Travelling
- At School
- Socialising/Relaxation

Which of the following activities do you typically utilise on a daily basis on your mobile device? *

Mark only one oval per row.

	Yes	No
Social Media (e.g. Facebook, Twitter, Instagram, Blogging)		
Reading Content (e.g. e Book, News, Articles)		
Accessing Email		
Messaging (e.g. Whats App, SMS)		
Searching for information on the Internet		
Getting News Alert		
Playing Games		
Listening to Music or Videos (e.g. Youtube)		
Record Videos, Take Photos		
Purchase Products or Services		

During Lectures, or otherwise do you currently use your mobile device to... *

Mark only one oval per row.

	Yes	No
search for terms used by the lecturer that you did not understand		
take pictures of the lecturer's notes?		
audio/video record the lecturers guidelines for assignments?		
read articles about the topic being taught?		
message fellow students about a topic or assignment?		
access your university virtual learning environment?		
download lecture notes?		
take part in class forums and blogs?		
schedule important deadlines on your calendar?		

Would you say that a mobile device is a central part of everyday life? *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree						Strongly Agree

Section 3 Cognitive Needs

To what extent do you agree with the following statements. *

1-Strongly Disagree, 5-Strongly Agree

Mark only one oval per row.

	1	2	3	4	5
I will use my mobile device to search for new information					
I will use my mobile device to answer questions coming from class discussions					
I will use my mobile device to access learning material anywhere, anytime					

Section 4 Affective Need

To what extent do you agree with the following statements. *

1-Strongly Disagree, 5-Strongly Agree

Mark only one oval per row.

	1	2	3	4	5
I like showing my friends how to use mobile devices					
I will enjoying learning using a mobile device					
I want to be a innovative user of new mobile functions, service and applications to achieve personal fulfilment					

Section 5 Social Need

To what extent do you agree with the following statements. *

1-Strongly Disagree, 5-Strongly Agree

Mark only one oval per row.

	1	2	3	4	5
I will use my mobile device to interact with other students					
I will use my mobile device to join discussion forums outside the classroom					
I will be more likely to ask others for help or to explain a topic by using my mobile device					

Section 6 Mobile Learning Self Efficacy

To what extent do you agree with the following statements. *

1-Strongly Disagree, 5-Strongly Agree

Mark only one oval per row.

	1	2	3	4	5
I feel confident in knowing how a mobile learning system works					
I feel confident in my knowledge and skill for using mobile learning					
I feel confident in performing the basic functions of mobile learning					

Section 7 Learning Relevance

To what extent do you agree with the following statements. *

1-Strongly Disagree, 5-Strongly Agree

Mark only one oval per row.

	1	2	3	4	5
Mobile learning will allow me to have the freedom and control of studying anytime, anywhere					
Mobile learning will allow me to be more efficient in my studies					
Mobile Learning will allow me to tailor my studies to fit my own needs					

Section 8 Subjective Norm

To what extent do you agree with the following statements. *

1-Strongly Disagree, 5-Strongly Agree

Mark only one oval per row.

	1	2	3	4	5
I am more likely to adopt mobile learning if my lecturers encourages me					
I am more likely to adopt mobile learning if my classmates do the same					
I am more likely to adopt mobile learning if my family encourages me					

Section 9 Perceived Ease of Use

To what extent do you agree with the following statements. *

1-Strongly Disagree, 5-Strongly Agree

Mark only one oval per row.

	1	2	3	4	5
It is easy to download and save learning content with mobile devices					
It is easy to learn new mobile learning applications					
It is easy to become skillful at using mobile learning applications					

Section 10 Perceived Usefulness

To what extent do you agree with the following statements. *

1-Strongly Disagree, 5-Strongly Agree

Mark only one oval per row.

	1	2	3	4	5
I think mobile learning can enable me to accomplish learning activities such as coursework more quickly and flexibly					
I think mobile learning can help me develop my learning skills					
I think mobile learning can increase my academic performance					

Section 11 Mobile Learning Preferences

When using a Mobile Learning Environments, I prefer that....................

1- Strongly Disagree, 5- Strongly Agree

Mark only one oval per row.

	1	2	3	4	5
I can continue with my learning outside the classroom					
I can access expert guidance to facilitate advance learning					
I can receive useful feedback at the right time and in the right place					
I can access course information that I need anytime anywhere					
I can conduct follow up investigations to find out answers to questions					
I can receive questions to promote thinking at the right time and in the right place					
I can think deeply and generate new ideas and questions					
It can offer opportunities for communication and collaboration with other students					
It can offer opportunities for communication and collaboration with my lecturers					
I can direct my own learning progress and study plan					

Section 12 Behavioural Intention

To what extent do you agree with the following statements. *

1-Strongly Disagree, 5-Strongly Agree

Mark only one oval per row.

	1	2	3	4	5
I have intention to perform mobile learning					
I am going to positively utilize mobile learning					
I think others should use mobile learning as well					

I will not get distracted easily when performing mobile learning by other internet related activities *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree						Strongly Agree

I would like my lecturers in the future to use Mobile Learning teaching strategies *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree						Strongly Agree

I Would like Mobile Learning to complement my traditional classroom learning experience *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree						Strongly Agree

The Teaching and Learning Process should be performed with any Mobile Learning Technologies *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree						Strongly Agree

Appendix 3 Permission Letter from Gatekeeper

Anglia Ruskin University
Lord Ashcroft International Business School
Faculty Research Ethics Panel
Lord Ashcroft Building (MAB 301)
Bishop Hall Lane
Chelmsford
CM1 1SQ

10 December 2015

Dear Mr. Andre Samuel,

This is to confirm that I give permission for you to carry out research at our organisation in your capacity as a member of staff at [redacted] for the purposes of your Professional Doctorate at Anglia Ruskin University.

I understand that by giving this permission I am granting you access to the students at [redacted] to collect data via an online questionnaire and focus group interviews. Additionally, to the use and ownership of the data collected.

I understand that you may disseminate findings at Anglia Ruskin University and elsewhere, including for publication.

I understand that our organisation will not be named in dissemination and every attempt will be made to ensure anonymity. I also understand that although every attempt will be made to do this, Anglia Ruskin University is unable to completely guarantee that the organisation could not be identified by any party.

Yours sincerely,

Appendix 4 Invitation Email to Online Survey

Mobile Learning Adoption Survey - MAY 2016 - EVENING COHORT — Yahoo/DBA

[redacted] — Tue, Dec 13, 2016 at 8:34 AM

Dear Students,

You have been invited to respond to this survey. **To begin the Survey please Click the Link below.**

Mobile Learning Adoption Survey

This research is focused on finding out the behavioural intention of adult learners to the adoption of Mobile Learning and will look at the factors that will influence their adoption. Additionally, the research will seek to evaluate the role mobile technology will play in supporting teaching and learning strategies.

This **study has received ethics approval** by the Lord Ashcroft International Business School Faculty Research Ethic Panel (FREP) under the terms of Anglia Ruskin University's Research Ethics Policy.

Participation is voluntary and you may withdraw from this survey at any time by closing the webpage. Once you submit your answers, your data will remain confidential under the Data Protection Act (1998) and any material published as a result of this data collection will not single out individual responses as the data will only be presented as aggregates, ensuring your anonymity.

The survey is anticipated to take **approximately 10 minutes to complete**. For more information on the survey and your rights as a participant please click here for the Participant Information Sheet

To begin the Survey please Click the Link below.

Mobile Learning Adoption Survey

Kind Regards

Appendix 5 Participant Information Sheet

PARTICIPANT INFORMATION SHEET

for

Mobile Learning Adoption Questionnaire

Section A: The Research Project

1. **Title of project**

Mobile Learning Adoption: Towards a Seamless Learning Model in Private Higher Education in Trinidad

2. **Brief summary of research.**

This research is focused on finding out the behavioural intention of adult learners to the adoption of Mobile Technology as a Learning aid and will look at the factors that will influence their adoption. Additionally, the research will seek to evaluate the role mobile technology will play in supporting teaching and learning strategies.

3. **Purpose of the study**

This questionnaire will provide the data required to produce a Doctoral thesis which is a partial fulfilment of a Professional Doctorate awarded by Anglia Ruskin University (UK).

4. **Name of your Supervisor**

[redacted]

5. **Why have I been asked to participate?**

You have been asked to participate because you are currently an adult learner studying at a private tertiary institution in Trinidad.

6. **How many people will be asked to participate?**

For this survey a sample size of 548 adult learners studying at the private tertiary institution will be invited to participate.

7. **What are the likely benefits of taking part?**

Participants will not directly benefit financially or otherwise from the research outcomes. However, during the research period you would benefit from the use of mobile learning tools during your course of study.

Additionally, the study my yield some useful insights into mobile learning adoption and associated learning strategies for adult learners.

8. **Can I refuse to take part?**

Your participation is voluntary and you have the right to refuse to take part without giving a reason. Under no circumstances you should feel coerced into taking part.

9. **Has the study got ethical approval?**

The study has ethical approval from Lord Aschroft International Business School Faculty Research Ethics Panel at Anglia Ruskin University on 11 January 2016.

10. **Has the organisation where you are carrying out the research given permission?**

The President/Founder of SAM Caribbean Ltd has given his blessings and permission to approach students of the institution to conduct this survey. Please note that your participation in this survey is voluntary and it is your decision whether you would like to take part.

11. **What will happen to the results of the study?**

The findings from the survey will form part of the documentation for a Professional Doctoral Thesis and will be disseminated at Anglia Ruskin University and elsewhere, including for publication.

12. **Contact for further information**

If you require and further information on the nature of the research project being conducted, please contact me at:

ars134@student.anglia.ac.uk

Section B: Your Participation in the Research Project

1. **What will I be asked to do?**

Participants will be required to complete an online survey via the use of an electronic form. Therefore, to respond to the questions you would need to click on the respective options to register your response. Upon completion of the survey you would click on the submit button.

You would be required to complete the questionnaire once and it should take no longer than ten (10) minutes.

2. **Will my participation in the study be kept confidential?**

All participants have the right to confidentiality, privacy and anonymity of their personal data provided in this survey. The researcher does not require to identify you directly therefore your physical identity will not be known to the researcher. Also your identity will be kept anonymous as the questionnaire is being completed online and no data will be collected on personal identifiers and personal sensitive information. Please also note that the option to collect your IP address has been disabled. Please see link to the online survey tool website's privacy policy. http://www.google.com/policies/privacy/

In the case of indirect identification through data such as cultural, economic and social, the results will be written up in anonymised format and identification would be suppressed by generalizing the findings by using statistical analysis, as such the findings will not be reported as individual items.

The data you submit would be stored on a cloud storage which is secured using a password and only the researcher will have access to it. The data would be loaded and transformed into an anonymised format using a coding technique onto a Statistical Software on the researcher's personal laptop which is secured by password and fingerprint. This dataset would only be accessed by the researcher, therefore, would not be disclosed to the public or any unauthorised individuals.

3. **Are there any possible disadvantages or risks to taking part?**

The researcher does not expect the study to cause any fatigue, distress or negative effect on your health. If you encounter any distress you can withdraw by closing the webpage. Please note that participation in this study does not affect the participant's legal rights.

4. **Whether I can withdraw at any time, and how.**

Your participation is voluntary and you can withdraw from the study at any time without giving a reason. Before starting the survey, you would be asked to give consent, this would be recorded in the dataset. If you do not wish to take part in the survey you can click No to question 1. If at any time during the survey you wish to withdraw, without having your data recorded, you can do so by exiting the webpage, if you would like your data to be recorded click the submit button at the end of the questionnaire.

Please note that it will not be possible to withdraw your data once the researcher has written the findings and submitted thesis for assessment or publication.

5. **Whether there are any special precautions you must take before, during or after taking part in the study.**

There are no special precautions or prerequisites for taking part in the study. You will receive an email with the URL to the survey, you can start by clicking on the link. You can use any internet connected device to access the survey, including your desktop, laptop or mobile device, which has a web browser.

6. **What will happen to any data that are collected from you?**

All data collected would be stored in an electronic format on password protected systems. The data would be processed in accordance with the Data Protection Act (UK) 1998.

The data collected will not be processed to support decisions relating to particular individuals or to damage or distress the participants. Please note as a result of the above the data collected will be held indefinitely.

7. **Contact details for complaints.**

If you have any complaints about the study, you can speak to the researcher or the researcher's supervisor. See contact details below. If however, your concerns are not addressed adequately you can lodge a complaint directly to Anglia Ruskin University's complaints committee. See contact details below.

Researchers' email address: ars134@student.anglia.ac.uk
Researchers' Supervisor: [redacted]
Anglia Ruskin University Complaints Committee:
Email address: complaints@anglia.ac.uk
Postal address: Office of the Secretary and Clerk, Anglia Ruskin University, Bishop Hall Lane, Chelmsford, Essex, CM1 1SQ.

Version 1.1

Appendix 6 FREP Ethics Approval Letter

Anglia Ruskin University
Cambridge Chelmsford Peterborough

Chelmsford Campus
Bishops Hall Lane
Chelmsford
CM1 1SQ
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Int: +44 (0)1223 363271
www.anglia.ac.uk

Dear Andre

11 January 2016

Project Title: "Mobile Education in Trinidad and Tobago: Towards a Seamless Learning Model in Higher Education"

Principal Investigator: Andre Samuels

I am pleased to inform you that your ethics application has been approved by the Faculty Research Ethics Panel (FREP) under the terms of Anglia Ruskin University's Research Ethics Policy (Dated 23/6/14, Version 1).

Ethical approval is given for a period of three years from the date above.

It is your responsibility to ensure that you comply with Anglia Ruskin University's Research Ethics Policy and the Code of Practice for Applying for Ethical Approval at Anglia Ruskin University, including the following.

- The procedure for submitting substantial amendments to the committee, should there be any changes to your research. You cannot implement these amendments until you have received approval from FREP for them.
- The procedure for reporting adverse events and incidents.
- The Data Protection Act (1998) and any other legislation relevant to your research. You must also ensure that you are aware of any emerging legislation relating to your research and make any changes to your study (which you will need to obtain ethical approval for) to comply with this.
- Obtaining any further ethical approval required from the organisation or country (if not carrying out research in the UK) where you will be carrying the research out. Please ensure that you send the FREP copies of this documentation if required, prior to starting your research.
- Any laws of the country where you are carrying the research and obtaining any other approvals or permissions that are required.
- Any professional codes of conduct relating to research or requirements from your funding body (please note that for externally funded research, a Project Risk Assessment must have been carried out prior to starting the research).
- Completing a Risk Assessment (Health and Safety) if required and updating this annually or if any aspects of your study change which affect this.
- Notifying the FREP Secretary when your study has ended.

Please also note that your research may be subject to random monitoring. Should you have any queries, please do not hesitate to contact me. May I wish you the best of luck with your research.

Yours sincerely,

Dr J Salkeld
Chair of the Faculty Research Ethics Panel (FREP)

Appendix 7 Additional outputs from SEM using IBM AMOS

AMOS Proposed Measurement Model Fit Analysis Output

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	119	1458.896	584	.000	2.498
Saturated model	703	.000	0		
Independence model	37	12565.171	666	.000	18.867

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.046	.811	.773	.674
Saturated model	.000	1.000		
Independence model	.435	.109	.060	.103

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.884	.868	.927	.916	.926
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.066	.062	.070	.000
Independence model	.228	.224	.231	.000

AMOS Proposed Structural Model Fit Analysis Output

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	38	75.564	17	.000	4.445
Saturated model	55	.000	0		
Independence model	10	1966.825	45	.000	43.707

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.044	.961	.872	.297
Saturated model	.000	1.000		
Independence model	.381	.293	.136	.240

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.962	.898	.970	.919	.970
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

RMSEA

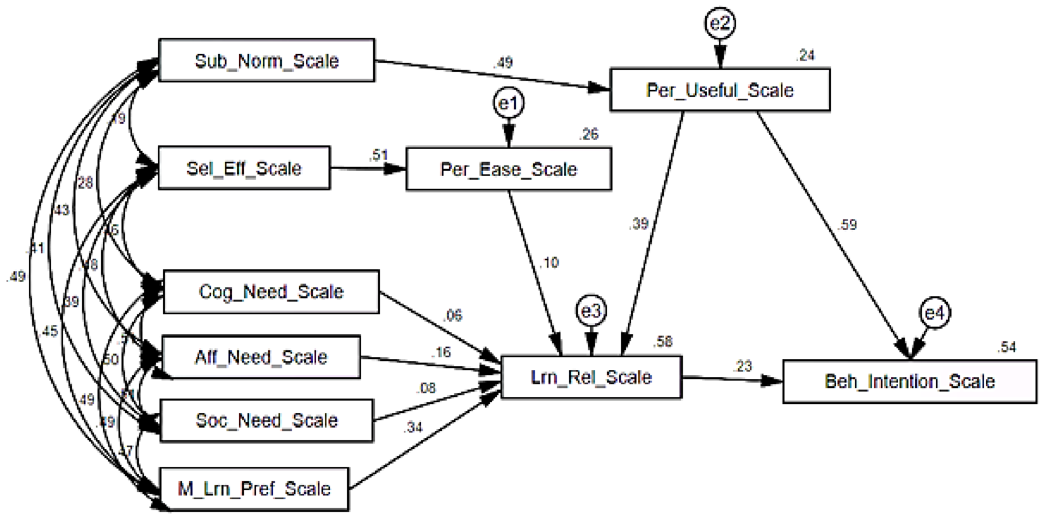
Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.100	.078	.124	.000
Independence model	.352	.339	.366	.000

Exploratory SEM- Structural Model using AMOS

MODEL 1

$R^2 = 0.54$

2 paths not sig

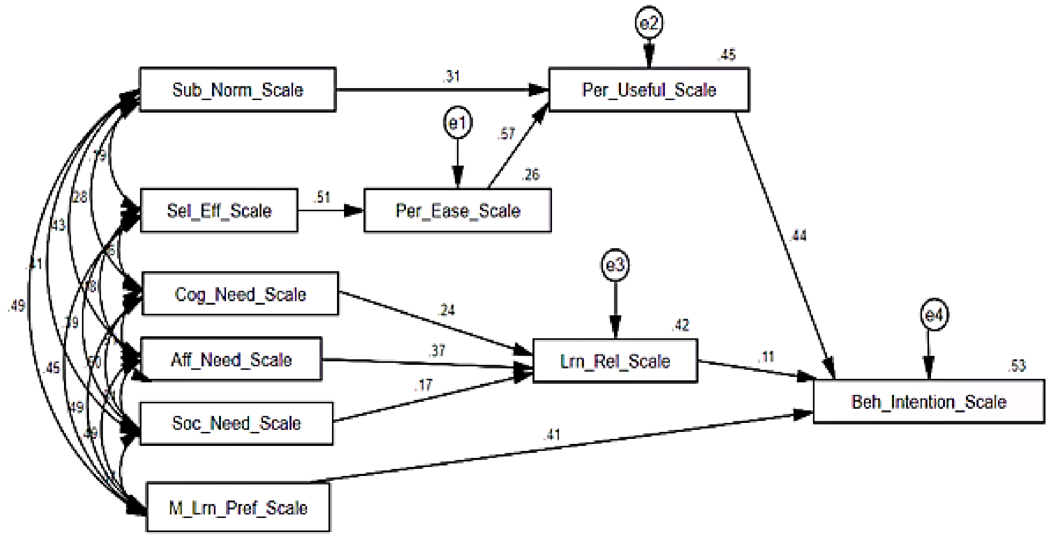


			Estimate	S.E.	C.R.	P
Per_Useful_Scale	<---	Sub_Norm_Scale	.433	.041	10.524	***
Per_Ease_Scale	<---	Sel_Eff_Scale	.523	.047	11.072	***
Lrn_Rel_Scale	<---	M_Lrn_Pref_Scale	.359	.047	7.651	***
Lrn_Rel_Scale	<---	Soc_Need_Scale	.070	.037	1.898	.058
Lrn_Rel_Scale	<---	Aff_Need_Scale	.142	.039	3.645	***
Lrn_Rel_Scale	<---	Cog_Need_Scale	.053	.037	1.407	.159
Lrn_Rel_Scale	<---	Per_Ease_Scale	.087	.033	2.634	.008
Lrn_Rel_Scale	<---	Per_Useful_Scale	.340	.032	10.734	***
Beh_Intention_Scale	<---	Lrn_Rel_Scale	.252	.048	5.264	***
Beh_Intention_Scale	<---	Per_Useful_Scale	.574	.042	13.730	***

MODEL 2

$R^2 = 0.53$

all paths sig

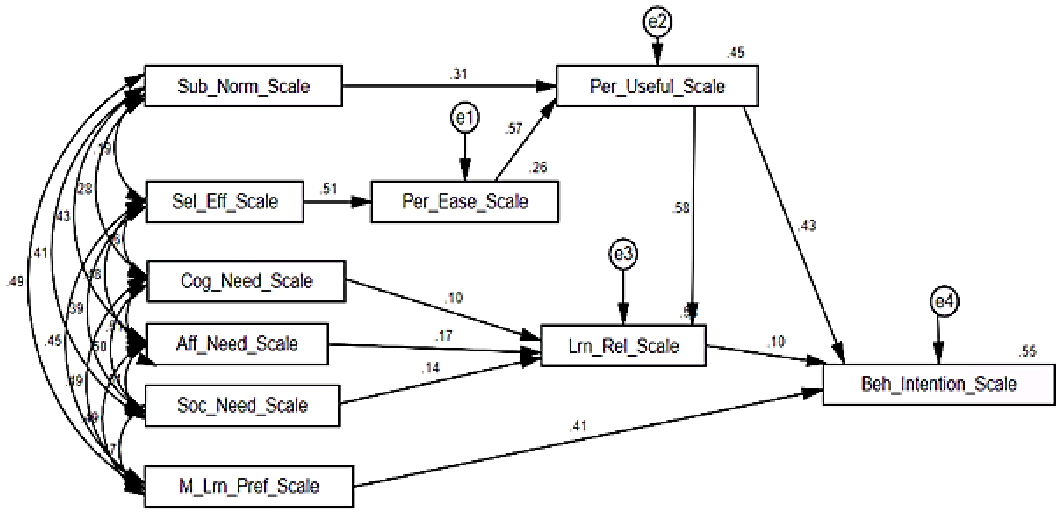


			Estimate	S.E.	C.R.	P
Per_Ease_Scale	<---	Sel_Eff_Scale	.523	.047	11.072	***
Per_Useful_Scale	<---	Sub_Norm_Scale	.257	.034	7.645	***
Lrn_Rel_Scale	<---	Cog_Need_Scale	.228	.048	4.729	***
Lrn_Rel_Scale	<---	Soc_Need_Scale	.165	.048	3.404	***
Lrn_Rel_Scale	<---	Aff_Need_Scale	.365	.050	7.292	***
Per_Useful_Scale	<---	Per_Ease_Scale	.562	.039	14.254	***
Beh_Intention_Scale	<---	Lrn_Rel_Scale	.096	.036	2.645	.008
Beh_Intention_Scale	<---	Per_Useful_Scale	.413	.036	11.348	***
Beh_Intention_Scale	<---	M_Lrn_Pref_Scale	.456	.045	10.093	***

Model 3

R^2 = 0.55

1 path not sig

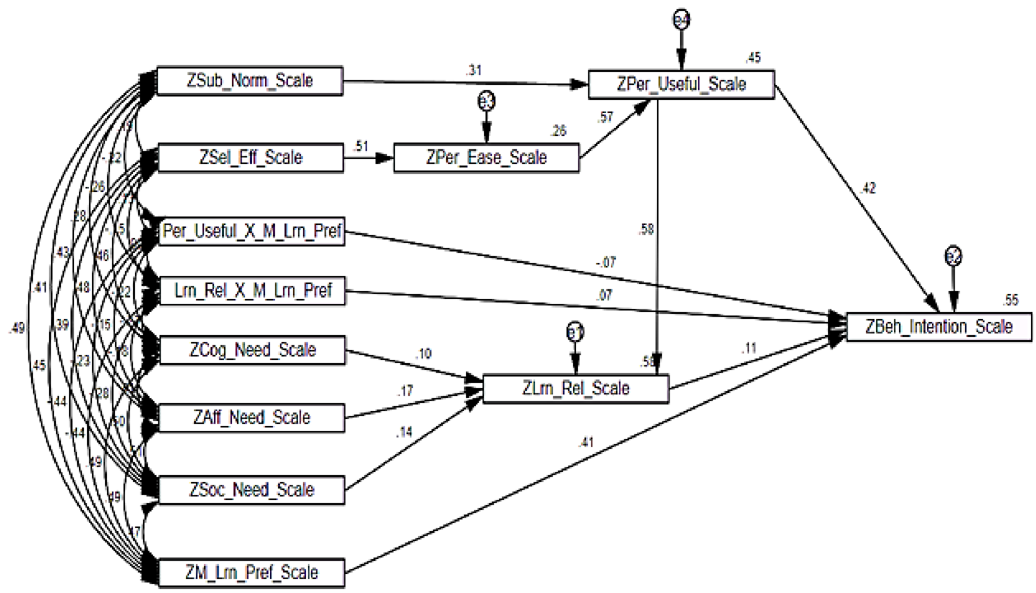


			Estimate	S.E.	C.R.	P	Label
Per_Ease_Scale	<---	Sel_Eff_Scale	.523	.047	11.072	***	
Per_Useful_Scale	<---	Sub_Norm_Scale	.257	.034	7.645	***	
Per_Useful_Scale	<---	Per_Ease_Scale	.562	.039	14.254	***	
Lrn_Rel_Scale	<---	Cog_Need_Scale	.092	.038	2.390	.017	
Lrn_Rel_Scale	<---	Soc_Need_Scale	.124	.039	3.189	.001	
Lrn_Rel_Scale	<---	Aff_Need_Scale	.160	.040	3.965	***	
Lrn_Rel_Scale	<---	Per_Useful_Scale	.563	.036	15.754	***	
Beh_Intention_Scale	<---	Lrn_Rel_Scale	.096	.051	1.895	.058	
Beh_Intention_Scale	<---	Per_Useful_Scale	.413	.048	8.663	***	
Beh_Intention_Scale	<---	M_Lrn_Pref_Scale	.456	.044	10.428	***	

Model 4- Model 3 Interaction of M_Ler_Pref

R^2= 0.55

Interaction Not Sig

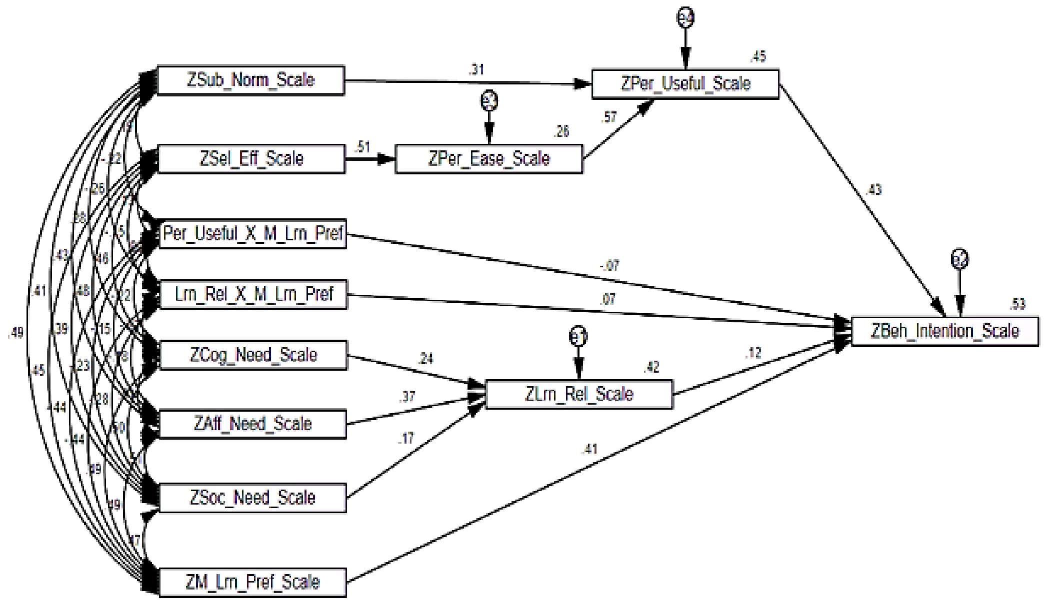


			Estimate	S.E.	C.R.	P
ZPer_Ease_Scale	<---	ZSel_Eff_Scale	.513	.046	11.072	***
ZPer_Useful_Scale	<---	ZSub_Norm_Scale	.293	.038	7.645	***
ZPer_Useful_Scale	<---	ZPer_Ease_Scale	.546	.038	14.254	***
ZLrn_Rel_Scale	<---	ZCog_Need_Scale	.097	.040	2.390	.017
ZLrn_Rel_Scale	<---	ZAff_Need_Scale	.163	.041	3.965	***
ZLrn_Rel_Scale	<---	ZSoc_Need_Scale	.129	.041	3.189	.001
ZLrn_Rel_Scale	<---	ZPer_Useful_Scale	.566	.036	15.754	***
ZBeh_Intention_Scale	<---	ZPer_Useful_Scale	.393	.047	8.400	***
ZBeh_Intention_Scale	<---	Lrn_Rel_X_M_Lrn_Pref	.040	.048	.849	.396
ZBeh_Intention_Scale	<---	Per_Useful_X_M_Lrn_Pref	-.041	.049	-.840	.401
ZBeh_Intention_Scale	<---	ZM_Lrn_Pref_Scale	.364	.039	9.399	***
ZBeh_Intention_Scale	<---	ZLrn_Rel_Scale	.109	.049	2.207	.027

Model 5- Model 2 with Interaction

R^2= 0.53

Interaction Not Sig



			Estimate	S.E.	C.R.	P
ZPer_Ease_Scale	<---	ZSel_Eff_Scale	.513	.046	11.072	***
ZPer_Useful_Scale	<---	ZSub_Norm_Scale	.293	.038	7.645	***
ZPer_Useful_Scale	<---	ZPer_Ease_Scale	.546	.038	14.254	***
ZLrn_Rel_Scale	<---	ZCog_Need_Scale	.239	.050	4.729	***
ZLrn_Rel_Scale	<---	ZAff_Need_Scale	.371	.051	7.292	***
ZLrn_Rel_Scale	<---	ZSoc_Need_Scale	.172	.051	3.404	***
ZBeh_Intention_Scale	<---	ZPer_Useful_Scale	.393	.036	10.992	***
ZBeh_Intention_Scale	<---	Lrn_Rel_X_M_Lrn_Pref	.040	.048	.848	.396
ZBeh_Intention_Scale	<---	Per_Useful_X_M_Lrn_Pref	-.041	.049	-.840	.401
ZBeh_Intention_Scale	<---	ZM_Lrn_Pref_Scale	.364	.040	9.138	***
ZBeh_Intention_Scale	<---	ZLrn_Rel_Scale	.109	.035	3.080	.002

Regression Weights for Final Model- Structural Model

			Estimate	S.E.	C.R.	P	Label
Per_Ease_Scale	<---	CMLP_Scale	.612	.050	12.194	***	
Per_Ease_Scale	<---	Sel_Eff_Scale	.288	.044	6.570	***	
Per_Useful_Scale	<---	Sub_Norm_Scale	.169	.034	4.938	***	
Per_Useful_Scale	<---	CMLP_Scale	.479	.059	8.115	***	
Per_Useful_Scale	<---	Per_Ease_Scale	.334	.047	7.095	***	
Lrn_Rel_Scale	<---	Cog_Need_Scale	.062	.037	1.665	.096	
Lrn_Rel_Scale	<---	Soc_Need_Scale	.077	.037	2.064	.039	
Lrn_Rel_Scale	<---	Aff_Need_Scale	.154	.039	3.962	***	
Lrn_Rel_Scale	<---	CMLP_Scale	.343	.056	6.097	***	
Lrn_Rel_Scale	<---	Per_Useful_Scale	.401	.044	9.193	***	
Beh_Intention_Scale	<---	Lrn_Rel_Scale	.120	.055	2.165	.030	
Beh_Intention_Scale	<---	CMLP_Scale	.369	.063	5.895	***	
Beh_Intention_Scale	<---	Per_Useful_Scale	.459	.053	8.651	***	

Squared Multiple Correlations for Final Model- Structural Model

	Estimate
Per_Ease_Scale	.485
Per_Useful_Scale	.580
Lrn_Rel_Scale	.660
Beh_Intention_Scale	.623