Profiling information behaviour of nursing students: Part 1: quantitative findings.

INTRODUCTION

Handling information is a key aspect of nursing care – from informal patient counselling through formal recording of care to reflection on practice, which increasingly requires appraisal of the research evidence. Library services have developed various information literacy initiatives for nursing students but many of these are based on assumptions of what this large group of students should do, not what they do, and why they do it. With a large student cohort of around 170,000 nursing students enrolled at higher education institutions in the UK in 2007/8 (Higher Education Statistics Agency, 2009), a validated model of the information seeking behaviour (ISB) for this group would inform design and evaluation of information support services for this diverse student group, composed of mature students as well as school-leavers. Factors that affect the way nursing students search may be as important as being taught how to search. Personality, learning styles and self-efficacy may all have a role to play in the success or otherwise of student information seeking behaviour.

This paper presents quantitative findings of a mixed-methods study on the development of information seeking profiles among nursing students, based on personality, self-efficacy and learning style.

LITERATURE REVIEW

Many conceptual models of ISB have been formulated including Wilson (1981), Ellis (1993), Wilson (1999), Ingwersen (1996), Kuhlthau (1993) and Saracevic (1996). Some of these models have been tested subsequently and each of these models focuses on a 'process' of information seeking which has a series of defined stages notably Ellis, Kuhlthau, although the more recent models do incorporate elements of 'looping' and 'feedback'. A lack of testing means it is unclear whether these models are over complicated and how closely related the different aspects of the models are. A more contemporary model formulated by Foster (2005), from grounded theory research with academics suggests that information seeking is substantially non-linear, in the sense that there is not a series of steps or stages, rather those seeking information begin and end at different points depending partly on various cognitive factors. For the purpose of this article, information seeking behaviour is defined as what takes place when an individual (or group) identifies an information gap and purposefully tries to fill it; whilst information searching includes the physical acts of looking for information. Logically, studies of information seeking may include elements of searching as indicated in Wilson's (1999) nested model.

From the data obtained from a longitudinal study of the use of electronic information services among academic staff and students in the UK, a model was derived of the mediating factors that influenced student use of electronic information services (in particular) (Urquhart and Rowley, 2007). This model embraced not just the factors associated with individuals but some of the contextual factors as well. The specific (micro) factors were information literacy (defined in terms of skills and knowledge that students could bring to searching), searching strategies (the type of searching routines normally adopted), academics' information behaviour (and their influence as role models for students), discipline, pedagogy (approach adopted to learning and teaching), and support and training (provided partly by library services, perhaps

acting in co-operation with academic staff). The macro (wider contextual) factors included availability and constraints on access, information resource design, technology infrastructure, organisational leadership, policies and funding. For UK nursing students, important policies include the impact of clinical governance, and the need to demonstrate evidence based practice. Much of nursing education involves education on placement in clinical settings where supervisors act as role models. In the academic setting, variations on problem based learning are the norm, with emphasis on reflection in, and on practice.

Information seeking within healthcare
Within the healthcare profession, studies and reviews of the information seeking, have reported consistently that situation is important: colleagues tend to be the first choice in the information searching behaviour process (Urquhart and Crane, 1994, Lathey and Hodge, 2001, Stokes and Lewin, 2004, McKnight, 2006, Tannery et al., 2007); with personal collections and bibliographic databases also well used (Lacey-Bryant, 2004, Dee and Stanley, 2005). This emphasis on which sources are used to satisfy particular types of query is a perspective of interest to information providers, but does not reflect the context of nurses' information seeking very well. Summarizing Virginia Henderson's definition of nursing, Marriner-Tomey (2006) states that nurses are expected to view patients as individuals that require help towards achieving independence, thus including the disclosure (or otherwise) of information. The nurse's role in information giving is focussed on patient care; deciding on what information is disclosed; and this involves emotional care. It is a two way process of communication, in a setting that may share some characteristics of the information ground (Fisher et al., 2004). And, just as people generally have adopted the Internet as part of their information ground for habitual information seeking, health professionals may do this as well. Hospital staff are inclined to use sources other than colleagues for information gathering, but tend to prefer using Google rather than library subscribed databases (Hider et al., 2009). The latter study also found that nurses used Medline more than CINAHL. Spenceley et al's (2008) meta-analysis of thirty-two studies of the information seeking behaviour of nurses conducted between 1985 and 2006 found that overall peers were the top ranked source of information. A set of eleven recent (2001-2007) high quality research studies (Cogdill, 2003, Dee and Stanley, 2005, Hall et al., 2003, Lathey and Hodge, 2001, McCaughan et al., 2005, McKnight, 2006, Secco et al., 2006, Stokes and Lewin, 2004, Tannery et al., 2007, Thompson et al., 2001b, Thompson et al., 2001a) were appraised to help explain preferences for colleagues (or the Internet) and understand how nurses might view their information seeking. The findings of analysis indicated that who was asked (doctor or nurse) depended on the availability of particular professionals in the work setting. Nurses' perceptions of themselves as poor information searchers (particularly with databases) and the focus on nursing tasks to be accomplished, mean that nurses view information gaps, and sense-making (Dervin, 2003) in terms of patient care needs (figure 1). The 'situation' in this model is related to the nurse's personal work environment and it is within that context that information seeking occurs. Despite the need for evidence-based practice within nursing, it is clear that bridging the sensemaking gap often involves personal knowledge and use of colleagues. This is not as great a discrepancy with the tenets of evidence based practice as it seems. Nurses are encouraged to use reflection during their initial training and subsequent professional development, as well as being encouraged to pass on knowledge to others (Nursing and Midwifery Council, 2008 pp51-58). This emphasis on reflection could affect nurses' formal searching skills if they rely on colleagues entirely, and cease to practise searching and appraisal. Lack of practice leads to lack of confidence in their competence.
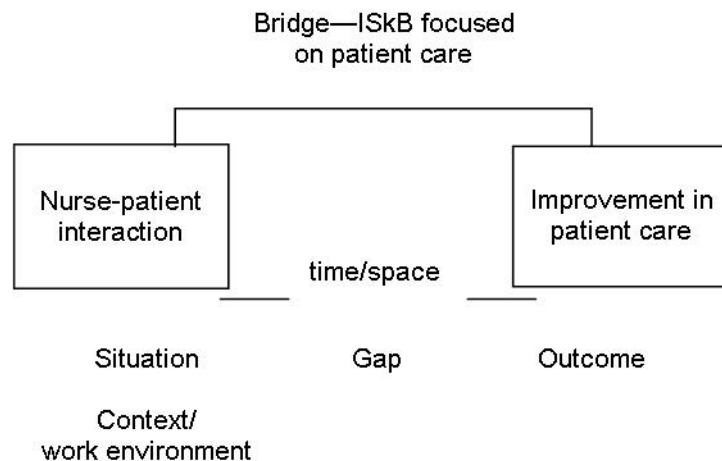
Figure 1: Dervin's Sense-Making model adapted to the nurse-patient information need situation

Information literacy
Library services often use the term information literacy to describe their programmes to develop nurses' confidence and competence in searching and seeking information. Information literacy means many different things (Virkus, 2003) – with different degrees of emphasis on IT, digital, information, and media literacy (Bawden, 2001). More recently, frameworks to consider ICT literacy have been developed (Markauskaite, 2006). The use of the term literacy needs to be critiqued (Buschman, 2009). Lloyd (2010), for example, argues that information literacy should be seen as a sociocultural practice, to be informed by practice theory. The contrasting assumptions of library services about information literacy were examined in a study of university web-based information literacy tutorials (Sundin, 2008). There is increasing emphasis on information literacy understood not simply as the knowledge and skills of the individual, but as part of a community with more emphasis on people's communities of practice (Harris, 2008), and O'Farrill (2010) suggests that in the workplace there should be more emphasis on the creation of meaning, sensemaking and effective information use as belonging to a situated practice. Literacy is thus increasingly seen as part of the situation in which people are and ideas about steady progression in skills associated with information literacy need to be questioned carefully.

Self-efficacy
The concept of self-efficacy, the sense of personal mastery in ones competence, therefore seems appropriate to study among nursing students and nurses. The concept of self-efficacy is one of the central constructs of Bandura's Social Cognitive Theory (SCT) (Bandura, 1986) {initially termed Social Learning Theory (Bandura, 1977b)} and indicates a person's self-belief in achieving a certain goal. Thus self-efficacy is a person's belief in their own ability to achieve (or otherwise) an outcome through their own behaviour. SCT is concerned with a range of concepts that fit into three core sets: behavioural, environmental and personal (Bandura, 1986 p24). Self-efficacy has been researched within academic settings (Pajares, 1996), but more so with respect to information technology (Compeau and Higgins, 1995, Eastin and LaRose, 2000, David et al., 2006) and with information literacy (Kurbanoglu, 2003, Kurbanoglu et al., 2006). The concept of self-efficacy as defined by Bandura (1977a) has been challenged. Eastman and Marzillier (1984) suggest that Bandura's initial experiments were too task specific at a micro-level and that the number of possible outcomes of the experiment for the participants limited, but they acknowledge that

"there is no doubt that people's assessment of their personal competence can be very powerful and accurate determinants of their future behaviour" (Eastman and Marzillier, 1984 p228). Kirsch (1985) contests Bandura's research with the main disagreement centring on the similarity of the concept of self-efficacy as defined by Bandura with Rotter's Social Learning Theory (Rotter, 1954).

Achievement in education has been linked to students' motivation to attain certain goals (Elliott and Dweck, 1988, Braten et al., 2004, Schmidt et al., 2006, Sins et al., 2008, Schunk, 1984); with some of these studies indicating a link with self-efficacy (Schunk, 1984, Sins et al., 2008, Braten et al., 2004). Intrinsically motivated individuals are also considered to perform better academically and be more creative (Ryan and Deci, 2000). Extrinsic motivation is regarded as doing something in order to achieve an outcome: a means to an end. Individual behaviour is value driven by the benefits of the necessary actions (Lin, 2007). Reviewing the literature Zimmerman (2000) concluded that self-efficacy shows "convergent validity in predicting diverse forms of motivation" (Zimmerman, 2000 p89). More recent empirical research appears to be less decisive regarding the link between self-efficacy and academic performance. Choi (2005) in a study of 230 undergraduates found that academic self-efficacy was not a significant predictor of academic performance. In addition, Camgoz and Tektas (2008) in a study of 261 university students found no relationship between self-efficacy and academic attributional style (explanation of causes of events). Both these studies used general self-efficacy scales. McLaughlin et al (2007) found that in a study of 384 nursing students, high self-efficacy (from an occupational perspective) was related to higher academic achievement; and Usher and Pajares (2006) established that academic achievement was related to self-efficacy in 468 pupils of varying ethnicity. Overall researchers have tended to support Bandura's theory that self-efficacy is positively related to an individual's achievement.

Personality
Turning to the cognitive factors, the role of personality and learning style has been well documented in academic settings (Bidjerano and Dai, 2007, Duff et al., 2004, Komarraju and Karau, 2005, Prospero and Vohra-Gupta, 2007) as contributory factors to motivation to learn and success. Results from these studies suggest that Conscientiousness and to a lesser extent Openness have positive relationships to successful learning. The Five Factor Model (FFM) is by far the most commonly used model for measuring personality at the present time. Although the terminology for each factor varies, the most often used terms are: Openness, Conscientiousness, Extroversion, Agreeableness, and Neuroticism, resulting in the acronym OCEAN. The FFM is sometimes distinguished from the 'Big Five' model (Saucier and Goldberg, 1996), but for the purposes of this review both models are treated as synonymous. Most of the main personality theorists believe personality to be a complex phenomenon, difficult to pin down, but vitally important. As McAdams notes "for Allport, Murray and Cattell no single trait, need, attitude or sentiment is to be seen as the key to personality" (McAdams, 1997 p12). If the view is that personality is extremely complex, can it at least be defined? According to Piedmont "personality can be defined as the intrinsic organization of an individual's mental world that is stable over time and consistent over situations" (Piedmont, 1998 p2). But is *personality* truly *stable* over time? Not according to the psychoanalysts Freud, Jung, and Adler. Is it truly *consistent* over situations? Not according to Allport, Murray or Cattell. A less restrictive definition is offered by Funder who suggests that personality is "an individual's characteristic patterns of thought, emotion, and behaviour, together with the psychological mechanisms – hidden or not – behind those patterns" (Funder, 2007 p5). Funder's definition is the consensual view that characteristics are ascribed

to individuals, these characteristics are generally stable, and are psychological in nature (Saucier and Goldberg, 2003).

Learning styles
One of the difficulties in discussing learning styles in information behaviour research is the confusion in terminology. There is no single definition of a learning style and indeed the term is often used synonymously with thinking styles, cognitive styles and learning modalities (BECTA, 2005); or with motivational styles, learning orientations and learning conditions (Coffield et al., 2004). There is some debate as to the benefits of using learning styles at all as they are seen to potentially stereotype or pigeonhole students (Scott, 2010). Entwistle and colleagues first developed the Approaches to Studying Inventory, a 64 item questionnaire with shorter 30 and 18 item versions in the early 1980's. It has since undergone a range of changes and has spawned the Revised ASI (RASI) and the Approaches to Study Skills Inventory for Students (ASSIST) in the mid-1990's and the Approaches to Learning and Studying Inventory (ALSI) in 2004 (Entwistle and McCune, 2004). Entwistle's initial research in the late 1970's drew upon earlier work by Marton and Saljo (1976) who coined the terms 'deep' and 'surface' in relation to learning approaches; and Biggs whose Study Process Questionnaire of the late seventies has since been revised (Biggs et al., 2001). From this Entwistle extended the approaches to include a 'strategic' type and the 60 item RASI included an 'apathetic' type. The development of the ASSIST merged the surface and apathetic types.

Information seeking behaviour research is wide ranging with the affect of personality documented as far back as 1967 (Clarke and James, 1967); with more contemporary analysis by Limberg (1999), Butler (2000), Hertzum & Pejtersen (2000). Heinstrom's analysis of the effects of personality and learning style on the ISB of postgraduate students is a key pointer to this research (Heinstrom, 2003, Heinstrom, 2002). Her study of 305 masters' students across a range of disciplines at a Finnish university investigated the link between learning style, personality and information seeking. She found that students with a deep approach to learning were positively linked with the personality trait of 'openness', whilst strategic learners were either extravert or conscientious. The surface learning style was positively linked with neuroticism and negatively linked with extraversion, openness, agreeableness and conscientiousness. She also found that deep learners put in a great deal of effort and sought high quality information, whilst strategic learners were characterized by wide and thorough information seeking. They sought information from many different sources, retrieved information by chance and found it easy to judge information critically (Heinstrom, 2002 p158). The surface learners were not thorough in their searching, and reported problems with relevancy judgements. They were also negatively correlated with good study results.

ETHICAL APPROVAL

The research was granted ethical approval by Cambridgeshire 3 Research Ethics Committee, Faculty of Health and Social Care at Anglia Ruskin University. In addition the Research and Development departments of the 13 local NHS organizations granted approval.

Purpose and research questions

The aim of this study is to profile the information seeking behavior of nursing students, according to learning style, personality and self-efficacy in information literacy

Phase 1: Quantitative
- What is the relationship between personality, self-efficacy, learning styles, and information seeking behaviour?
- What is the impact of differing personalities, self-efficacy levels, and/or learning styles on information seeking behaviour

METHODOLOGY

A concurrent embedded quantitative dominant mixed-methods approach was used on a sample of nursing students enrolled on courses at a Higher Education Institution. Creswell (2009) summarizes the usefulness of this type of strategy in that it allows either the comparison of the two data sources or for them to reside side by side as "two different pictures that provide an overall composite assessment of the problem" (Creswell, 2009 p214). He goes on to suggest that the researcher can use this approach to address different research questions as is the case in this study and summarizes the attractions and limitations of this strategy as follows:

Attractions:
- Data can be collected simultaneously
- Advantage of using both types of data
- Researcher gains differing perspectives from the two methods

Limitations:
- Data needs to be transformed in some way to allow integration
- If data is compared, discrepancies may occur
- Unequal status between the methods leads to disadvantages when interpreting the results

By addressing different research questions integration of the data is reduced and little comparison is required. In addition by specifying research questions for each method a separate focus is provided allowing analysis to be concentrated on each type of data. As such the following research questions were formulated for the other phases of the study which although not reported here are given to provide a holistic view of the research:

Phase 2: Qualitative
- Why do users search the way they do?
- What are the preferred methods of information seeking?

Phase 3: Mixed
- How do the qualitative data inform the development of the information seeking behaviour profile?

Despite the current controversy both for (Johnson et al., 2007, Morgan, 2007) and against (Giddings, 2006, Symonds and Gorard, 2008) mixed methods as a legitimate research methodology both from an epistemological/ontological and a semantic perspective, the technique has been used in an ever increasing number of research

projects (Lipscombe, 2008, Bryman, 2008). The view here is that by using both quantitative and qualitative methods a deeper, richer understanding of the ISB process could be attained. This is in line with the Johnson et al. (2007) definition of mixed methods as offering "a powerful third paradigm choice that often will provide the most informative, complete, balanced, and useful research results (Johnson et al., 2007 p129).

The quantitative aspect of the research revolved around a 5 part questionnaire which included an information seeking element (discussed in more detail in the next section), three other research tools, and collection of demographic data for the respondent. Pre-validated research tools for 1) personality (Mini-Markers) (Saucier, 1994), 2) learning styles (ASSIST) (Entwistle, 1997) and 3) self-efficacy (Kurbanoglu et al., 2006) were used to enhance validity and reliability of those aspects of the questionnaire. These tools were selected in part due to their brevity as the overall questionnaire length needed to be manageable. Approval for use of the Learning Styles questionnaire (shortened version) was obtained from original developer (Noel Entwistle); approval for 17-item version of Self-Efficacy scale was obtained from the developer (Serap Kurbanoglu); the Mini-Markers tool is available online for educational use, although permission for use was granted by developer (Gerard Saucier). The qualitative aspect was a semi-structured interview with the focus on a critical incident and not reported in this paper.

Two hundred and sixty one individuals were invited to participate in the quantitative analysis with 194 (74%) filling in the questionnaire fully. The sample was a snapshot of several cohorts at different stages in their programme, and of different 'types' of student e.g. undergraduate, postgraduate, continuing education nurses etc. Students were approached by the researcher in the classroom (tutor cooperation granted), initially to be informed about the research and provided with a letter of invitation and an information sheet outlining the research. A week later, after a period of reflection, the students were seen again in the classroom to complete the questionnaire and sign consent forms.

QUESTIONNAIRE DEVELOPMENT

Foster's model
Foster's research showed that rather than having a 'chain' of events linked together in a particular direction, the ISB process was in essence non-sequential involving a series of loops, feedback, and with differing start and end points. He describes the process as non-linear, holistic, dynamic and flowing (Foster, 2004 p235). From this analysis Foster developed a new model of ISB clearly differing from early 'stage-based' models. This model contained three Core Processes (opening, orientation, consolidation), within three levels of contextual interaction (cognitive approach, internal context, and external context).

In identifying the Core Processes Foster was able to recognize and categorize eighteen separate 'micro-processes' in the ISB process. These are given in Table 1 below.

Opening	Orientation	Consolidation
Breadth exploration	Problem definition	Knowing enough
Eclecticism	Picture building	Refining
Networking	Reviewing	Sifting
Keyword searching	Identifying keywords	Incorporation

Browsing	Identifying the shape of existing research	Verifying
Monitoring		Finishing
Chaining		
Serendipity		

Table 1: showing the three core processes and eighteen micro-processes within Foster's ISB model. See Foster (2004) for a full description of these processes

These micro-processes were used to develop the ISB section of the questionnaire used in this research. Each micro-process (apart from Finishing) was used to formulate a two juxtaposed questions; one in line with the concept of the micro-process, the other contradicting this. It was deemed that 'Finishing' did not lend itself to this type of analysis as it was clear that this was equivalent to the end of the information seeking process and therefore could not have two juxtaposed statements as options.

The respondents were asked to select which of the two statements they tended to do the most during their information seeking process. The Core Processes and juxtaposed options for the respondents are outlined in Appendix 1.

The non-linearity aspect of Foster's model is not under direct investigation in this research, it is the micro-process elements within the model that are being assessed. In particular, is there evidence for such processes, and are particular personality types, self-efficacy levels, or learning styles associated with particular micro-processes?

Personality - *Mini-Markers*

This is a 40 item self report personality scale listing single descriptive terms. The respondent is asked to score each term on a scale from one to nine with one being completely inaccurate and nine completely accurate. The 40 items are compiled into 5 groups of eight terms corresponding to the Big Five personality factors. The scores for each term are added within the respective group and divided by eight to give a score for each factor. The scale is not used to determine whether individuals are a particular personality type i.e.: extrovert; as it is possible to score high (or low) on all five dimensions, but is used to compare between individuals or groups within each dimension. The reason for this is the way the scale is set up and scored. Extroversion, Agreeableness, and Conscientiousness have four positive and four negative terms; whereas Neuroticism has two positive and six negative terms, and Openness six positive and two negative terms. The implication of this is that Neuroticism scores are generally lower than the scores for the other four dimensions; and Openness scores generally higher. By comparing within the dimension this discrepancy does not apply. Further, Saucier termed 'Neuroticism' as 'Emotional Stability' and the score from the test indicates how emotionally stable an individual is. Thus the more negative the score – the less emotionally stable. The Mini-Markers inventory is a reliable and valid tool when compared with other personality scales such as: Goldberg's 100 item scale (Dwight et al., 1998); Goldberg's 50 item scale (Palmer and Loveland, 2004); the Big Five Inventory (DeYoung, 2006); and the NEO-FFI (Olver and Mooradian, 2003). The Mini-Markers has also been tested across cultures using English, Greek and Chinese versions on large cohorts of undergraduate students (Nye et al., 2008) with promising results. The ease of use, brevity, and simplicity of the scale make it a valuable assessment tool when questionnaire space is limited (Dwight et al., 1998, Palmer and Loveland, 2004).

Self-efficacy - *Information Literacy Self Efficacy Scale (ILSES)*

The short 17 item version of the ILSES contains statements regarding the confidence or perceived proficiency of the respondent regarding a range of information literacy tasks. These tasks cover Beginner level, Intermediate, and Advanced. Each statement is scored by the respondent from one to seven with one being no confidence at all to complete the task and seven being extremely confident. The overall score is then used to determine the overall level of self-efficacy of the respondent. Beginner level constitutes scores of 17-51 inclusive; Intermediate is 52-85; and Advanced is 86-119. This relatively new scale has been used to test student teachers self efficacy. Uslel (2007) investigated the information literacy self-efficacy of 1702 student teachers using the ILSES. She reduced the 28 item scale to 20 items although it is not clear why 8 items were removed as the resulting Cronbach alpha score was slightly reduced to 0.90. The resulting 20 items were grouped into 4 separate areas: analysis and evaluation of information; using ICT and searching; citing resources; and using the library. Uslel found that student teachers had a high level of information literacy self-efficacy and that their ICT use increased with experience. Small scale research on the information and computer literacy of 68 teachers also used the 28 item ILSES in conjunction with a computer literacy scale, and follow up interviews (Erdem, 2007). Erdem found that there was a link between the two literacies with teachers tending to either have high scores on both scales, or low/moderate scores on both. Although no research has been found that uses the shortest 17-item version of the ILSES, Kurbanoglu ascertains that the "17 item refined scale, which can be used to determine subjects' self-efficacy levels for information literacy, exhibits high reliability without excessive length" (Kurbanoglu et al., 2006 p734).

Learning Styles - *Approaches to Study Skills Inventory for Students (ASSIST)*

The short 18 item version of the ASSIST contains statements regarding how students study. The statements cover the three learning styles types of: deep, strategic, and surface. Each statement is scored by the respondent on a four point scale with one corresponding to strongly disagree and four corresponding to strongly agree. The 18 statements are compiled into three groups of six statements corresponding to the three learning styles and scores are summed together to determine the style of the respondent. A higher composite score for a single style means an individual is that type; when scores are level the individual is deemed to have a mixed style. Although the longer length version of the ASSIST is most widely used the short versions of the ASSIST have also been used in primary research. Good teaching was linked positively with deep and strategic learners, and negatively so with surface learners. They also found that clear goals and standards were linked with strategic learners, whilst appropriate workload was linked with deep and surface learners. All learning styles were linked (not significantly) to examination grade. The scale has also been found to be reliable and valid elsewhere (Coffield et al., 2004, Speth et al., 2007).

A pilot study was performed to test face validity of the ISB section of the questionnaire and to ascertain whether the length was suitable. Twenty students were asked to fill in the questionnaire and note any concerns or difficulties. The results were generally favourable with the only minor concern the overall length. The scales for personality, self-efficacy and learning styles were already at their minimum so reducing the questionnaire further could have compromised the results. To ensure the maximum potential of the study it was necessary for all participants to complete

all three of these scales to enable the maximum possible analysis. It was therefore decided that the questionnaire should remain in its entirety for the study.

RESULTS

Of the 194 students completing the questionnaire in full the vast majority were on the three year undergraduate nursing programme (n=139), with 35 doing a Continuing Professional Development module, 12 on the Masters course, and 7 were undergraduate midwifery students. Overall there were 72 first year students, 44 second years, and 43 third years. Those doing the modules were not classed as in a particular year as the modules were less than a year in length. Student age was broken down as follows: 31 were under 20 years old, 75 were between 21 and 30, 46 between 31 and 40, 35 were 41-50, and 7 were 51-60.

Self-efficacy

Very few respondents (n=8) considered themselves novices in respect of information literacy, with the majority (n=123) being 'Advanced'. Those undertaking a module had the highest percentage of 'Beginners' (17%), whilst of those on the Masters programme only one student was not 'Advanced' (Table 2).

It would be expected that as students progress through their studies they would become more confident in their information literacy skills. The results do not however support this expectation. The highest percentage of 'Advanced' students was for those in the second year of their course. This could be due to students gaining confidence from year one to year two, but when they start year three and begin their dissertation and research modules they lose confidence in their ability. However, this can only be speculative. A chi-square test to explore whether there was any association between level and information literacy self-efficacy showed no association (chi-square=0.15, p=0.99, 3 degrees of freedom)

In general terms younger students are more confident in their abilities than the older students. The age group 31-40 has the highest percentage of 'Advanced' students (72%), but both under 20's (68%) and the 21-30 age group (64%) also have large majorities of 'Advanced' students.

Learning Styles

The largest fraction of students was Strategic learners (39%), with 25% Deep, and 14% Surface. A total of 41 students had no single learning style, 34 were classed as 'Mix' (two scores the same) and 7 were 'Allrounders' (all three scores the same). Undergraduate nursing students had a high level of Surface learners (17%), postgraduates had a high level of Strategic learners (46%), and CPD students had a high level of Deep learners (29%).

The highest percentage of Strategic learners for any individual year were first year students (43%), with third year students having the highest percentage of Deep learners (33%). Second years showed the highest percentage of Surface learners (25%). Those without a clear learning style (Mix and Allrounder combined) declined across the three year programmes from 25%, to 20%, then to just 12% in year three.

Strategic learners constitute the largest fraction within all age ranges (up to age 51-60), with Surface learners the fewest in all ranges. As students get older their learning style appears to become more Deep and less Strategic.

Course	Information Literacy Self-efficacy		Learning Style			
	Intermediate/ Beginner	Advanced	Deep	Strategic	Surface	Mix/ Allrounder
RN 1st year	23	41	16	29	7	12
RN 2nd year	10	31	8	14	10	9
RN 3rd year	17	17	9	13	7	5
Masters	1	12	4	6	0	3
CPD	16	19	10	14	2	9

Table 2 showing Information literacy and learning styles numbers of students from different cohorts
Note: midwifery students omitted from table due to low numbers.

In terms of the relationship between Self-efficacy, Learning Style and course (table 2), despite apparent differences in learning style preferences as students progress, a chi square test of the association between level (year one, two, three, Masters/CPD) showed no significant relationship (chi=0.28, p=0.99, 9 degrees of freedom).

The results for the individual factors of learning style and information literacy self-efficacy indicate that no single factor seems to be making a difference across the levels of the course, although the numbers within each level are relatively low – making demonstration of small but significant changes difficult.

Accordingly, to examine the interactions the analyses were conducted on the entire group.

Self-efficacy and Learning Style

		Learning style			
		Deep	Strategic	Surface	Mix/Allrounder
Self-efficacy	Beginner	0	3	2	3
	Intermediate	11	24	13	15
	Advanced	38	49	13	23
Total		49	76	28	41

Table 3 Relationship between learning style and information literacy self-efficacy

Crosstabulation of self-efficacy and learning style (table 3) shows that the ratio of Intermediate and Advanced ILSE (Information Literacy Self Efficacy) students is 1:1 for the Surface learning style, but deep learning styles were far more likely to be associated with advanced levels of self-efficacy. For the chi-square analysis to test whether there was a relationship between learning style and self-efficacy in information literacy, the beginner and intermediate groups for self-efficacy were merged, as the beginner group was too small for sensible analysis. There is a significant association between learning style and self-efficacy in information literacy (chi-square 8.684, p=0.034, 3 degrees of freedom).

Self-efficacy and Personality

		Mean Personality score				
		Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness
Self efficacy	Intermediate/ Beginner	0.317	2.012	1.294	-1.903	3.266
	Advanced	0.988	2.327	1.798	-1.666	3.576

Table 4 Relationship between information literacy self-efficacy and mean personality score.

For personality types, the Intermediate/Beginner ILSE students have lower scores for all the personality traits than Advanced ILSE students (table 4). In other words, the advanced group in information literacy self-efficacy appear more extrovert, more agreeable, more conscientious, more stable emotionally, and more open, although it must be stressed this is an association, not cause and effect. Another study of self-efficacy and information literacy has used motivation as a personality factor (Pinto, 2010: Pinto & Sales, 2010). Results showed for translation students that motivation increased as students progressed, as did self-efficacy (although, interestingly, there was no increase between two of the levels, equating approximately to second and third undergraduate years). A study of online learning preferences (Lin & Vassar, 2009) indicated that preferences for online learning were associated with higher levels of self-efficacy, and satisfaction with the course. Motivation and self-efficacy seem to be related to each other, but do not necessarily move in parallel. Being motivated may help to overcome difficulties in learning some difficult, threshold concepts, and success should increase self-efficacy. If the personality factors for an individual are relatively stable over the period of three to four years of a learning programme, then it seems that some students may be blessed with intrinsic personality traits and motivation that help them achieve high levels of information literacy self-efficacy. Other students may require some extrinsic motivation to encourage them in their learning.

Learning Style and Personality

		Mean Personality score				
		Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness
Learning Style	Deep	0.906	2.117	1.449	-1.969	3.804
	Strategic	0.683	2.329	1.933	-1.633	3.423
	Surface	1.031	2.009	1.232	-1.799	2.862
	Mix	0.533	2.415	1.625	-1.695	3.577
	Allrounder	0.107	1.430	0.768	-1.625	3.357

Table 5 Relationship between learning style and mean personality score

Crosstabulating Learning Style with Mean Personality score (Table 5) shows that Deep learners are the most Open, but least Emotionally Stable. Strategic learners are the most Conscientious and Emotionally stable (disregarding Allrounders) partially supporting Heinstrom's (2003) research. Surface learners are the most Extravert, but the least Conscientious (disregarding allrounders) and Open,

suggesting that surface learners may be less inclined to work diligently as they may lack the required attitudes, or do not see the need to work in particular ways. Students with a Mixed Learning Style scored highest for Agreeableness. The results for the allrounders are hard to interpret, with comparatively low scores for extraversion, agreeableness, conscientiousness, but a high score for emotional stability.

The above findings will be used in later analysis and modelling, but the models to predict behaviour based on certain characteristics need to be informed by the qualitative analysis as well as some practical considerations of the type of tests that would be feasible to conduct on a regular basis with students.

Information seeking behaviour

ISB micro-process agreed	Number	Percent
Serendipity	170	87.6
Reviewing	169	87.1
Identify keyword	169	87.1
Problem definition	168	86.6
Keyword searching	155	79.9
Eclecticism	146	75.3
Chaining	143	73.7
Browsing	140	72.2
Incorporation	131	67.5
Knowing enough	125	64.4
Sifting	115	59.3
Verifying	111	57.2
Networking	107	55.2
Refining	99	51.0
Identify shape of current research	76	39.2
Breadth exploration	74	38.1
Picture building	72	37.1
Monitoring	41	21.1

Table 6 Frequency of agreement by students on micro-processes done

The number of positive responses for each micro-process is given in table 6. It shows that more than 50% of the students appear to use fourteen of the eighteen micro-processes with a maximum of 87.6% of students agreeing with the positive Serendipity statement. Monitoring is undertaken by the fewest students.

Odds Ratios

Odds ratio analysis was undertaken to investigate the likelihood of students with particular Learning Styles or Self-efficacy levels performing the micro-processes as part of their ISB strategy (tables 7 and 8).

Learning Style*	ISB process		
	Opening	Orientation	Consolidation
Deep	Breadth Exploration Networking Browsing	Identify Keywords	Sifting
Strategic	Eclecticism Keyword Searching Serendipity	Problem Definition Identify Shape of Current Research	Knowing Enough Refining Sifting Verifying
Surface	Networking	Reviewing	
*Only odds of higher than 1.5 are shown in this table.			

Table 7 Micro-processes most likely to be undertaken by students with different Learning Styles.

Deep learners are more likely to perform breadth exploration, networking, browsing, identifying keywords and sifting. Strategic learners are perhaps surprisingly likely to undertake serendipity and eclecticism, processes more akin of Deep learning. The other Strategic processes are what would be expected. Both Networking and Reviewing are most likely performed by Surface learners, also to be expected as these processes require less planning and searching.

Self-efficacy*	ISB process		
	Opening	Orientation	Consolidation
Advanced	Keyword Searching Chaining	Problem Definition Identify Keywords	Knowing Enough Refining Sifting
Intermediate/Beginner	Monitoring	Identify Shape of Current Research	
* Only odds of higher than 1.5 are shown in this table.			

Table 8 Micro-processes most likely to be undertaken by students with different self-efficacy levels.

Only Monitoring and Identifying the Shape of Current Research are most likely performed by Intermediate level ILSE students. The Advanced group are more likely to think about their search (problem definition) and work out search strategies (use of keywords). They also appear to prefer to build or adapt their searches as they progress (chaining, refining, sifting).

ISB and Personality

The personality scores for students who did indicate they performed a micro-process were compared with the personality scores (for the five traits) for students who did not perform the process, and ranked. The column rankings were then examined to check whether a single trait stood out (table 9). For example, when examining the average personality scores for students who said they did breadth exploration with average personality trait scores for students who said they did not do breadth exploration, extraversion was the only personality trait ranked 1 (with a higher score for those who did the process than those who did not). This type of comparison was repeated across all the micro-processes.

Personality trait	Higher personality score for a single trait when students agree	Higher personality score for a single trait when students

	with the statement	disagree with the statement
Extraversion	Breadth exploration	
Agreeableness	Eclecticism	Chaining Incorporation
Conscientiousness		Serendipity
Emotional Stability		
Openness	Browsing	Problem definition Reviewing Identify keywords

Table 9 Single personality traits associated with micro-processes

Aspects of the profile of traits for agreement with the micro-process make plausible sense. One might expect that browsing (process) and openness (trait) might be related, and that eclecticism (willingness to collect) could be associated with agreeableness. If students viewed serendipity as going off on a tangent, then conscientious students might avoid serendipity. Openness as a personality trait does also seem to be associated with an unwillingness to focus on problem definition, or reviewing, or identifying keywords.

DISCUSSION

Questionnaire development was a key aspect to this research. By using pre-validated scales for personality, learning styles and self-efficacy, the validity and reliability of the overall questionnaire was enhanced. The formulation of single juxtaposed statements encapsulating the essence of the micro-processes in Foster's model could be contentious, but it did provide the opportunity for quantitative analysis.

The link between Advanced self-efficacy, a Deep learning style and the Openness personality trait suggests these characteristics may be related to intelligence and perseverance. Being prepared to put effort into the learning process and having confidence in your information literacy level does imply a higher degree of these traits. As Kurbanoglu et al (2006 p731) states "individuals with a high self-efficacy perception expect to succeed and will persevere in an activity until it is completed" The higher odds for Deep learners of Breadth Exploration, Browsing, and Sifting supports the notion of students being willing to explore during their ISB process and is in line with Heinstrom's (2003) study.

A Strategic learning style is also linked to Advanced self-efficacy, but has a much higher proportion of Intermediate students. This suggests that a lower confidence level requires a more deliberate and calculated style of learning and searching. A high level of Conscientiousness (Table 5) supports this notion of wanting to be well organized to facilitate learning – again in line with Heinstrom (2003). Higher odds for Keyword Searching, Problem Definition, Identifying the Shape of Current Research, Knowing Enough, and Refining for Strategic learners is thus to be expected, but Serendipity and Eclecticism do not appear to fit. It would not be expected that a Strategic learner would want to collect anything and everything, nor that they would expect relevant information to be chanced upon. Later research on the validation of the Foster model (Foster et al., 2008) suggested some of the micro-processes were best viewed as a cline. Eclecticism might have been appropriate as a description for the academic researchers on which the model was based, but for a less sophisticated group of information seekers, Collecting would be more appropriate. The combination of Serendipity and Eclecticism for the strategic learners could be

interpreted as a willingness to do a bit of collecting, but in the hope that they find something quickly, by happy chance.

Surface learners have lower self-efficacy than other learner types suggesting a link between low confidence and the way students learn. Kurbanoglu's (2003 p639) ascertain that "individuals with low perception of self-efficacy anticipate failure and are less likely to attempt or persist in challenging activities" clearly links with the Surface learner type. The positive link to Networking and Reviewing may indicate that students prefer to ask others and to stick with what they have found before rather than search either for themselves or afresh. Surface learners link with Extraversion is counter to Heinstrom (2003) who found a positive link to Neuroticism.

The links between micro-processes (and core processes) and information literacy self-efficacy (Table 8) may have some implications for information literacy programmes. One interpretation is that the advanced group can confidently enter and leave information seeking at any point and can switch between the core processes with ease. However, the intermediate group need to get oriented first, and Identifying the shape of current research may simply be an expression of getting some bearings on the literature for a particular topic.

One of the emerging themes in the research is, hopefully, a better understanding of information behaviour, or perhaps information practice in the sense that habits of information seeking are important. The qualitative part of the research will help to explain how students and staff view information literacy in terms that make sense to them for learning more about nursing knowledge and practice.

CONCLUSION

It is clear there are relationships between students with differing attributes and aspects of Foster's ISB model. Deep, Advanced learners put more effort in and link to those processes that meet that requirement, whereas Strategic learners – less confident in their ability, but also more Conscientious – are more purposeful in their ISB. Surface learners with low confidence try to avoid literature searching, preferring to ask others or use what they already have. It may be that knowledge of which attributes students have, would enable tailored ISB instruction to different students. Analysis of the interviews will hopefully provide some pointers to those aspects of this research that at first glance appear rather contradictory.

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Appendix 1

Showing the Core Processes of Foster's non-linear information seeking model along with the two juxtaposed options developed for the questionnaire.

Opening	Definition	Options
Breadth exploration	Conscious expansion of searching, start broad and then narrow down	a. I tend to start my search broad and then narrow down later b. I prefer to try and find exactly what I want straight away, then broaden my search out if necessary
Eclecticism	Accept and store information for later use, combines active, passive and serendipitous acquisition	a If I come across information that looks interesting, but isn't immediately useful – I store it for later use b I ignore information that isn't readily needed
Networking	Conferences, social, colleagues, department groups	a I use my social network (friends, colleagues) to obtain information b I tend to search for information on my own and don't consult with friends and colleagues
Keyword searching	Databases, e-journals, Internet, browsing a key concept, choice of keywords an issue	a I think searching specific databases is important b I think the information will turn up somehow regardless of how much time I spend locating the right source
Browsing	Generally used to change a focus/topic	a I often keep scrolling through most of my search results long after selecting some pertinent articles. b I don't bother scrolling through my results after selecting some pertinent articles.
Monitoring	Ongoing process to update sources already found. Use websites, TOCs	a I regularly keep track of key journals and authors by accessing new issues and editions b I always perform a search to find new information
Chaining	Ancestry citation searching	a I often check the reference list of key articles for additional sources b I don't tend to use other article's

		reference lists as information sources
Serendipity	Associated with Breadth Exploration, Eclecticism, Networking	a I feel that I can often find useful information whilst looking for something else. b I do not feel that I can often find useful information whilst looking for something else.
Orientation	**Definition**	**Options**
Problem definition	Define focus and boundaries	a I think defining my focus and boundaries are important b I don't consider defining a focus as being a major consideration in information searching
Picture building	Mind-mapping concepts	a I often use mind mapping to build a picture of my search concepts b I tend to start searching with keywords rather than building a picture of a search strategy
Reviewing	Use existing knowledge and sources to determine current situation	a I tend to use my existing knowledge and sources to determine the current situation in my topic area b I don't consult previously obtained information to determine the current state of existing knowledge
Identify keywords	Finding suitable terms	a I think finding suitable terms is important in a search b I think I can get the information I need without worrying too much about keyword selection
Identify shape of existing research	Identifying key names, articles, latest opinion. Selecting sources (relevance)	a I judge the relevance of information by its relationship with key articles, authors and latest opinion b I determine whether information is relevant by looking at the title or abstract
Consolidation	**Definition**	**Options**
Knowing enough	Sufficient material	a I am usually able to decide when I have enough information for an assignment. b I usually find it difficult to assess when I

		have enough information for an assignment.
Refining	Deciding on boundaries	a I can easily define boundaries for a database search. b I find it difficult to define boundaries for a database search.
Sifting	Selecting, pruning (relevance)	a I check articles for relevancy regularly during a search. b I tend to get lots of articles before checking them for relevancy.
Incorporation	Pause and assemble collected material	a I tend to do my research in stages in order to collate my retrieved material. b I tend to collate my retrieved material when I have completed searching.
Verifying	Limited to accuracy of references	a I like to check the accuracy of key articles by searching for original sourced references b I tend to take the information presented in an article at face value
Finishing	*Stage before closure*	*NOT INCLUDED*