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Profiling information behaviour of nursing students: part 2: derivation of profiles

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Abstract

Purpose – The purpose of this paper is to develop information behaviour profiles for nursing students, to help inform information literacy programmes.

Design/methodology/approach – The methods include further analysis of quantitative findings (previously reported in part 1), together with qualitative research data collection and analysis. Critical incident type interviews with 11 students were transcribed and analysed using an interpretative categorisation method that used dendrograms for data display and analysis. From the regression analysis of the quantitative data, the micro-processes for information seeking were linked to learning styles, and then to personality traits to generate information seeking profiles. Integration of the qualitative findings led to development of a task-based information search model.

Findings – The start list of seven categories for qualitative analysis (derived from a literature review) was refined (one category added, one removed, with some relabelling). The quantitative data analysis revealed seven profiles (deep adventurer, deep identifier, deep investigator, strategic all-rounder, strategic collector, surface co-ordinator, surface skimmer, each linked to a particular learning style, personality trait, and preferred information seeking micro-processes).

Research limitations/implications – The data were collected at only one university and the profiles and the model need to be validated with data from other groups of nursing students. The findings on micro-processes consolidate and extend previous research.

Practical implications – The profiles should inform information literacy programmes as they show that information search profiles may be more varied than assumed. The information search model extends previous task-based information search models.

Originality/value – The information search profiles have not been identified previously.

Keywords Information retrieval, Individual behaviour, Personality, Students, Learning, Information literacy

Paper type Research paper

Introduction

Part I of the paper (Stokes and Urquhart, 2011) discussed the quantitative findings of a mixed-methods doctoral research study on the development of information seeking profiles among nursing students, based on personality, self-efficacy, and learning style. The quantitative element of the study used a questionnaire (sample $n = 194$) consisting

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of three validated scales for personality (Saucier, 1994), learning styles (Entwistle, 1997), and self-efficacy with information literacy (Kurbanoglu *et al.*, 2006), a section on information seeking preferences based on Foster's (2004) model, as well as some demographic questions.

Bawden and Robinson's (2011) chapter on "information styles" summarises many studies that investigated the role of learning styles, self-efficacy, and personality in terms of information-related behaviour finding many plausible and consistent relationships. Particular personality traits and differing learning styles seem to influence the way individuals search for information with individual studies finding marked relationships between conscientiousness and strategic learners; and between openness and deep learners (Diseth, 2003; Diseth and Martinsen, 2003; Diseth, 2011). These results are confirmed by Halder *et al.* (2010) and Heinstrom (2002, 2006) who also concluded that surface learners did not search thoroughly and tended to attain lower marks. Kwon and Song (2011) found relationships between extraversion, conscientiousness, and openness with a higher degree of self-reported competency with information evaluation tasks amongst college students (similar to results elsewhere; Saleem *et al.*, 2011); with conscientiousness and openness being linked to competency with the development of search strategies.

Library services have developed various information literacy initiatives for this large group of students but many of these seem to be based on assumptions of what students should do, not what they do, and why they do it. Some studies have examined the development of information literacy (Cole and Kelsey, 2004), and others note that confidence depends on the situation (Elmborg, 2006; Cool, 2001). Ideally information literacy initiatives for nursing students should not only help them through their course, but also prepare them for professional practice. Whether it is possible, in the academic setting to gain a full understanding of information literacy as "people in practice" (Lloyd, 2012) is questionable, but it is certainly a worthwhile goal.

The qualitative part of the research helped to explain how students view information literacy, what it means to them when trying to learn more about nursing knowledge and practice through searching for information. This paper describes the qualitative findings, the integration of the quantitative and qualitative findings, and the development of searching profiles. These should help the tailoring of information literacy instruction as suggested by some researchers (Detlor *et al.*, 2011; Dunaway and Orblych, 2011).

Literature review

For the purpose of the research, information seeking behaviour was defined as what takes place when an individual (or group) identifies an information gap and purposefully tries to fill it. 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. Student information seeking has often been described in terms of comfort or convenience (MacDonald *et al.*, 2011; Prabha *et al.*, 2007; Zach, 2005). Models of information seeking behaviour among students include a model of the mediating factors that influenced student use of electronic information services (in particular) (Urquhart and Rowley, 2007). 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. This model is a reminder of the contextual factors that influence information seeking by students in any particular situation. The further development of Foster's model (Foster and Urquhart, 2012), using the data set from the JUSTEIS project (Urquhart and Rowley, 2007; Urquhart *et al.*, 2003b) clarified the importance of extrinsic context for the information seeker (time, social networks, physical location, and resource access). The internal context of Foster's original model was found to be better described as intrinsic context, and the importance of personality, learning style, knowledge, affect, self-efficacy, and motivation was highlighted from study of the JUSTEIS dataset.

There are obviously many factors that could be studied about information seeking. For example, the focus of interest might be task, and types of task classified (Liu and Belkin, 2008). Task-based information seeking models are often based on the work of Bystrom and Jarvelin (1995). Several other factors apart from work task type and search task type also influence information searching tactics (Xie and Joo, 2012). The context might be group-based information seeking, and the focus the impact of personality traits on information behaviour in this context (Hyldegard, 2009). The research described in this paper aimed at the development of profiles that might help information literacy programme planners deal with nursing students. Heinstrom (2002, 2003, 2006) identified groups of information seekers according to combinations of their preferred learning style and personality traits. Extroversion, openness, and conscientiousness were identified as significant predictors of perceived information literacy competency among students, and a gender effect identified as well (Kwon and Song, 2011). Using an information seeking behaviour inventory developed by the researchers, Halder *et al.* (2010) found that personality traits correlated with aspects of information seeking behaviour among students. Among psychologists, however, neither cognitive styles nor aspects related to self-efficacy affected professional information seeking behaviour, but aspects of task, subdiscipline, and nature of research involvement did influence behaviour (Krampen *et al.*, 2011). Distance learners' self-efficacy for information seeking may affect their motivation for online learning (Tang and Tseng, 2013). Steinerová and Susol (2005) profiled information behaviour in the academic environment of users and authors/information publishers. The literature on personality traits, and cognitive/learning styles was applied to the findings on information behaviour to develop two extreme user profile types – type S (strategic or pragmatic) and type A (analytic), with a mixed group (P). Most students were type S.

Student reactions to what they find are classically considered under the relevance of information retrieval research, although relevance is a multi-dimensional construct (Schamber *et al.*, 1990) and – for students, at least, gets mixed up with convenience of access to full text (Connaway *et al.*, 2011; Urquhart *et al.*, 2003b). Steinerová's (2008) conclusion that relevance is linked to "value", "utility", and "importance" may be diluted by the convenience of availability, and pertinence a more accurate description than relevance. Research aimed at improving the user friendliness of IR systems showed that natural scientists tended to search in a different way from social scientists. The disciplinary differences related to the preferred information seeking and thinking styles of the disciplinary groups (Vilar and Žumer, 2008). Some research has indicated that nurses' electronic searching skills may be poor (Koivunen *et al.*, 2010; Morris-Docker *et al.*, 2004) and disordered (Roberts, 2004) but such judgements may take less account of the searching situation and the pertinence of items retrieved at the time.

For evidence-based practice, there is a presumption that searching should be systematic and that research found should be critically appraised. Some studies indicate a gap between practice and the ideal (Haines *et al.*, 2010; Koivunen *et al.*, 2010; Verhoeven *et al.*, 2009). Studies of nurses and nursing students consistently demonstrate a reliance on informal sources of information (Dee and Stanley, 2005; Spenceley *et al.*, 2008; O'Leary and Mhaolrunaigh, 2012). Perhaps information literacy for nurses should be interpreted in terms of the way nurses do nursing, and manage information as part of professional practice (Sundin *et al.*, 2008).

Eyre (2012) points out that students doing vocational programmes often compartmentalise what is taught within the university and what they learn from practice – knowledge transfer has to confront the messy world of practice. Integrating theory and practice and applying this to coursework assignments may be difficult. It may be more productive to think of information seeking as sense-making: "a focus on verbings offers a different entry for the search for systematic understandings of the human condition. Instead of focusing on elusive, ever-changing and constantly challenged nouns, Sense-making mandates a focus on the hows of human individual and collective sense-making and sense-unmaking" (Dervin, 1999, p. 731). Foster and Urquhart (2012) used more "verbings" in the revised Foster model, to describe the micro-processes of information seeking more accurately converting "Problem Definition" to "Defining a Problem", and "Identify Shape of Existing Research" to "Identifying Sources".

Additionally the remaining five micro-processes have been "verbed" as follows:

(1) "Breadth Exploration" to "Exploring Breadth";

(2) "Eclecticism" to "Collecting";

(3) "Serendipity" to "Chancing";

(4) "Identify Keywords" to "Identifying Keywords"; and

(5) "Incorporation" to "Incorporating".

Ethical approval

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

Qualitative data collection and analysis

Sampling

Participants for the qualitative phase were selected, randomly, from the sample used in the quantitative analysis. In total, 20 students were contacted by e-mail to take part but only four students responded positively. The remaining 16 were e-mailed again (as recommended in evidence-based guidance for enhancing response rates; Weightman *et al.*, 2009) and seven more were willing to take part, making a total of 11. Qualitative researchers are inclined to prefer to sample purposefully for research as participants can be selected that have experience of the phenomenon that is being explored (Creswell and Plano-Clark, 2011, p. 173). Here the quantitative sample provided the pool for selection for the qualitative sample (to prevent the introduction of personal characteristics that might hinder any data comparison; Creswell and Plano-Clark, 2011, p. 183), and as these were anonymous it was not possible to purposefully select

a representative sample of students. The 11 participants for the interviews comprised three Year 1 students, four Year– 2 students, two Year 3 students, one Master's student and one student doing a continuing professional development module. Obtaining participants from the all three years of the undergraduate programme was useful in that there are different expectations of what students should be attaining in terms of acquiring and analysing information (Anglia Ruskin University, 2011).

Interviews

Each interview took place at a single site in a single location at different times during 2009, with the duration ranging from just over 15 minutes to almost 25 minutes. The interviews were taped, subsequently listened through a single time, and then listened and transcribed in full. The critical incident technique (Flanagan, 1954) was used, as this should permit easier and fuller recall of an information seeking event (Urquhart *et al.*, 2003a). The main aim of the interview was to explore the reasons for seeking information, the searching strategies used, and what the habitual searching patterns might be.

Coding of qualitative data

The approach to qualitative analysis synthesised features of the work of Burnard (1991), Miles and Huberman (1994) and Sandelowski (2000, 2010) and uses the Critical Incident Technique (1954). This blended method of qualitative analysis, termed qualitative interpretative categorisation (QIC) (Stokes and Urquhart, 2013) uses a priori categories and data displays in the form of dendrograms. It is expected that throughout the coding of the data that the list will be refined (and the meaning clarified), some categories may be removed, and some others may be created. The start list was generated from the research questions and interview schedule (Stokes and Urquhart, 2013) and comprised amount of information, confidence, critiquing (information), relevancy, satisfaction with searching, searching techniques, and sources used.

Dendrograms were created and refined throughout the coding process depicting the hierarchical structure and proximity of nodes. This was a descriptive analysis, not a statistical cluster analysis. The final set of dendrograms showed the hierarchical structure of each node listed within the final list of top-level categories, and the relationships between codes in the data displays were examined.

Quantitative analysis

Initial findings already reported (Stokes and Urquhart, 2011) hinted at the potential development of profiles. Additional statistical analysis was undertaken subsequently to attempt to firm up these relationships. These examined relationships between personality traits and the information seeking behaviour micro-processes, all described as "verbings".

Regression analysis

Binomial logistic regression was performed to check for any significant relationships between the five personality traits and the ISB micro-processes (Table I).

Table I confirms aspects of the descriptive analysis reported in the previous paper (Stokes and Urquhart, 2011) of mean personality scores for each ISB micro-process. It shows that the highest ranked micro-process for mean score for agreeableness

(reviewing), highest two ranked micro-processes for conscientiousness (sifting and verifying), and the top ranked micro-process for openness (browsing) are all positively related to a significant level. In terms of negative relationships, picture building and identifying the shape of existing research (ranked 15th and 17th) for agreeableness for students disagreeing with the micro-process are significantly negatively related to this trait. No significant relationships with ISB processes were found for extraversion or emotional stability.

Qualitative data analysis – results

The 11 students that took part in the semi-structured interviews are referred to within the text according to Table II.

Categories

The initial start list of categories showed minimal amendments with only three significant alterations (Table III). It was clear from an early stage that a separate category for "Searching differently" was required and a new category of "Revision of searching" was created. This category took some data from the "Search techniques" category which was becoming overloaded with separate search strategies. Changes in the search process as the search progresses stayed within "Search techniques", but the category was renamed to the broader "Search strategy" to indicate that the data within included the initial search as well as the follow up. In addition the "Critiquing" category was excluded as this was generally a "Yes/No" response from the participants and did not yield any further meaningful information.

Table I. Significant relationships ($p < 0.05$) between the five personality traits and ISB micro-process

Personality trait	Positive relationship (p-value)	Negative relationship (p-value)
Extraversion		
Agreeableness	Reviewing (0.045)	Picture Building (0.004) Identifying Sources (0.029)
Conscientiousness	Sifting (0.016), Verifying (0.020)	
Emotional Stability		
Openness	Browsing (0.016)	

Table II. Interviewee codes

Course/stage of course	Code
RN 1st year	I-1
	K-1
	L-1
RN 2nd year	D-2
	H-2
	M-2
	V-2
RN 3rd year	E-3
	L-3
Masters	G-MSc
CPD module	S-CPD

Within the "Search strategy" category an initial sub-category of "Problems with searching" appeared to be mainly keyword searching and could be moved to the sub-category of "Keywords" which was already within "Satisfaction with Searching". This then became "Keyword selection". "Relevancy" became a sub-category within the broader category "Pertinence" to better indicate the bearing of the retrieved document in relationship to the information need. Creation and refinement of nodes took place throughout the analysis with clustering of groups via dendrograms.

Category 1: amount of information

Description: this category contains nodes pertaining to the student's perception of the extent of information needed for a particular assignment with the nodes grouped into sub-categories of: before commencing the assignment, during the writing up of the assignment, and in the final stages of the assignment near completion (Figure 1). This category differs from "Revision of searching" which comprises searching for different information/topics or a different method of searching.

The interview data showed a clear difference between the amount of information needed at the start of the assignment as opposed to at the end. There was more

Table III.
Initial start list and final set of categories used in the QIC process

Initial start list	Final categories
Amount of information	Amount of information
Confidence	Confidence
Critiquing	removed
Relevancy	Pertinence
	Revision of searching
Satisfaction with searching	Satisfaction with searching
Searching techniques	Search strategy
Sources used	Sources used

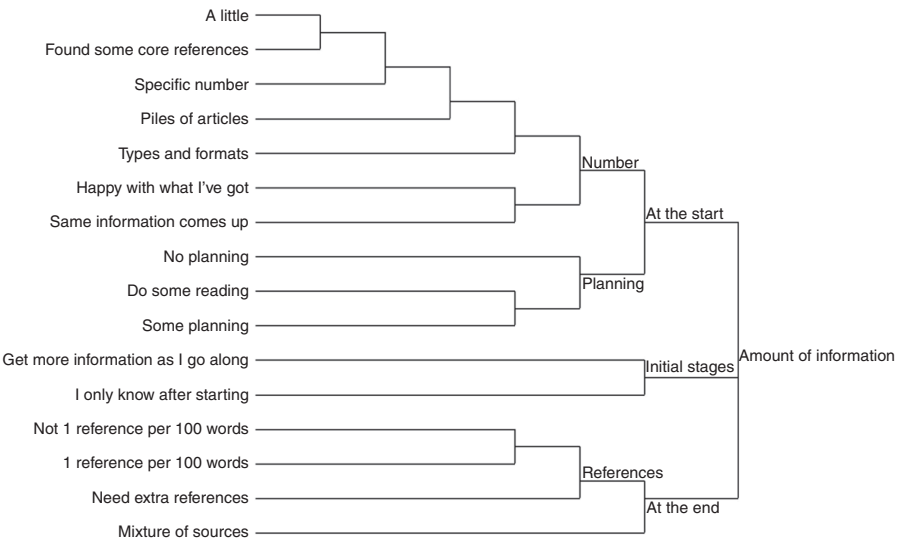

Figure 1.
Dendrogram of the nodal structure within the category for "amount of information"

emphasis on getting a few quality references in order to get the assignment up and running, but then a feeling of needing to have plenty of references at the end – more quantity.

Most students felt they needed to have a ratio of ten references per a thousand words. All four second year students gave clear statements to this effect encompassed by D-2:

> We got told in the first year by somebody that you're supposed to have one per every hundred words you write. So therefore we get so het up over "I've got to have forty references" or whatever (Student D-2).

The three first-year students gave differing emphasis to the amount of information they needed at the end of their assignment. I-1 wanted a mixture of sources, K-1 wanted ten references per a thousand words, but L-1 did not believe that it was necessary to have so many references.

Student L-3 stated that she only knew whether she had a reasonable amount of information after she started the assignment, collecting more as she went along. Others did make clear they performed additional searches after starting and this notion was linked with having a few main references to begin with by K-1:

> I want to start an assignment with five or six to start me going. I then tend to go back to get some more references I need (Student K-1).

Category 2: confidence

Description: confidence here describes whether a student's level of confidence in relation to searching for information has changed over time (Figure 2). For first-year students it only covers from assignment to assignment within that year, for other students it can include confidence levels over different years as well as different assignments.

It is generally expected that students become more confident with searching for information as they progress with their studies, but the results here show this is not always the case. Some students interviewed here did state they were more confident now than earlier in their course, for example:

> I am [more confident] with the digital library, when I first started that was just sort of way over my head about what I was meant to be doing. Now I've used it more I'm getting a bit better (Student H-2).

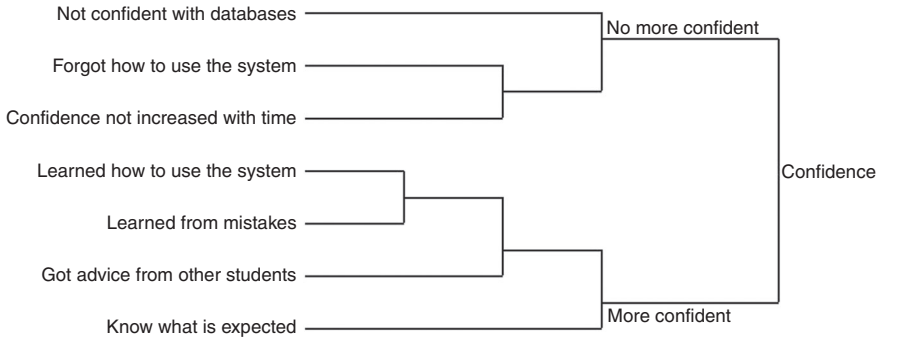

Figure 2.
Dendrogram of the nodal structure within the category for "confidence"

Other students, however, still had concerns which generally revolved around forgetting how to use the system or a lack of familiarity. For example:

> I did get more confident, then I seem to have lost it in the last assignment we did. It seems to have tailed off slightly and I think that was because I don't know – I think I lost the plot slightly (Student D-2).

> Not particularly [more confident], but then I don't do them regularly. I mean I haven't done one for five years. So I did two together which was quite good, but then I haven't done one for five years and I kind of like forgotten most of what I'd done (Student S-CPD).

These results appear show that whilst the notion of progression of information literacy through a course (or with experience) is assumed, the idea that this progression is a steady process cannot be assumed.

Category 3: pertinence

Description: the pertinence category contains nodes pertaining to how a student would decide if a piece of information was of use for their assignment. Sub-categories formed from these nodes were for information direct from the article, within or about the article, and for other criteria (Figure 3).

Respondents did not initially state that a single element was most important to them, rather they identified a range of elements of pertinence:

> E-3: Probably a combination of the title of the article and the age, because occasionally you'd get some over ten years old and I tend to look at those last.

> E-3: I'd probably skim through the abstract and then the article as well and if I think it's got a lot of information in I'd download it and print it off and read it in more depth (Student E-3).

Three students did identify the "relevance bar" (a small bar to the left of the summary information of an article within the digital library) as being something they checked for relevancy.

After additional probing by the interviewer, however, the availability of fulltext appeared to be the factor that held sway after initially looking at other elements. The following section being typical:

> G-MSc: I tend to look at the first twenty that spring up because they are the most up to date.

> G-MSc: Yeah the most recent come up first. Then I look at full text.

> Interviewer: What's the most important thing, date?

> G-MSc: Er, no full text (Student G-MSc).

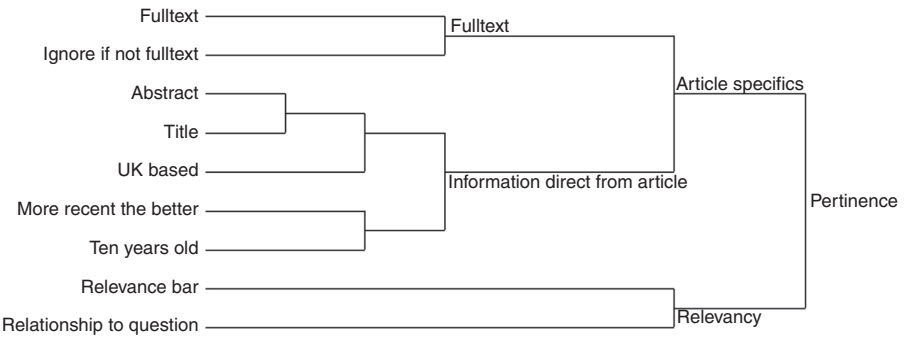

Figure 3.
Dendrogram of the nodal structure within the category for "pertinence"

Students appear to initially check elements such as the title and date, before checking the fulltext availability, and then in most cases the ease of getting the fulltext "trumps" any initial usefulness of the article. As Connaway *et al.* (2011, p. 187) state "information-seekers frequently defined convenience as complete access to resources, beyond merely discovering and identifying them".

Category 4: revision of searching

Description: revision of searching as already stated differs from "Amount of information" in that it covers a change of search and why the change took place rather than quantity of information. In addition this category includes whether the critical incident search differs from other searches the student has carried out (Figure 4).

Changing the search was done in an attempt to get the "right" information. All students (except G-MSc who stated that she did a digital library search and then focused it down within the same databases) had tried different search strategies at

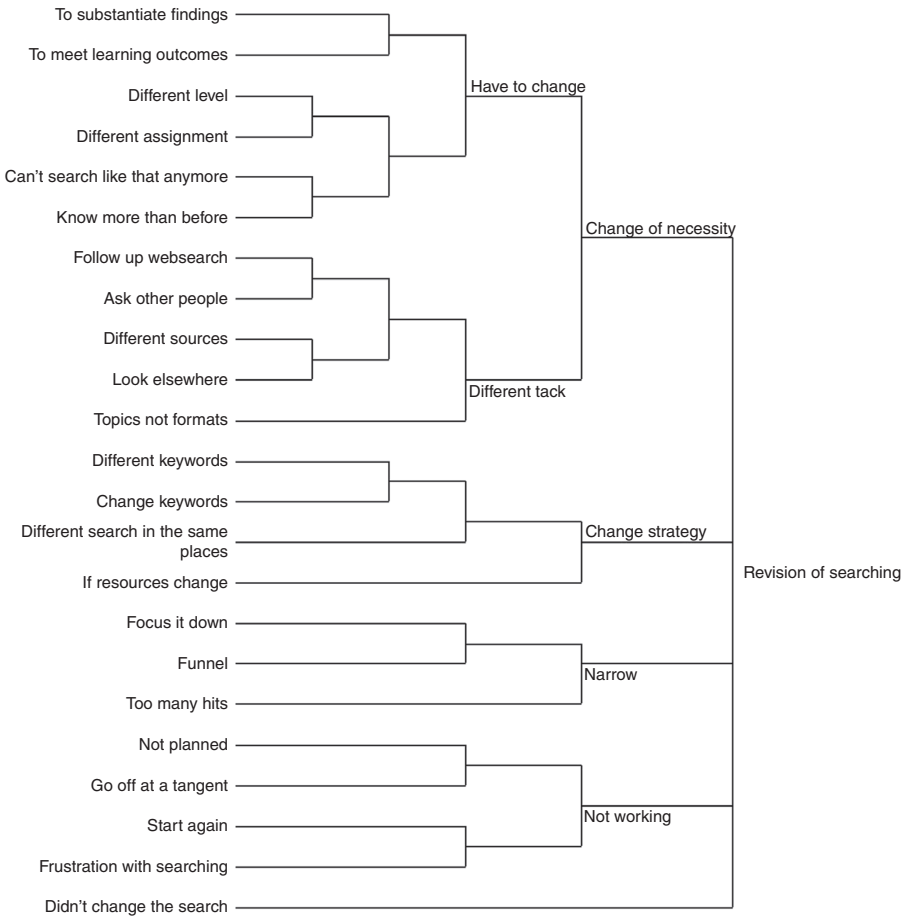

Figure 4.
Dendrogram of the nodal structure within the category for "revision of searching"

some stage. There was a variation of techniques with some students initially searching for books and then moving on to journal articles:

> I'd say at the beginning part would be more about books and just general information and then that would lead onto journal articles a little bit later on (Student V-2).

> Well, we had quite extended reading list for the first one because […] I think I didn't use different varieties of literature I only used books, now I know that you can use books, digital library, electronic resources (Student I-1).

Other students did the opposite and began their search with journal articles and only when this did not locate the relevant information did they turn to books:

> […] if I'm not getting the information I want from journals I'll go to books there […] probably Internet first then books (Student L-1).

Searches that "fail" by either retrieving too little or too much information also lend themselves to a revised search. Five students specifically stated that they changed keywords in an attempt to refine their search epitomised in the following:

> Yeah, probably. I don't know if I change my technique, just change how I word it and different areas I choose to look at different aspects (Student H-2).

So students tried to "improve" their searches in order to locate more relevant information, whether because they feel they have to or because they believe there is something better out there.

Category 5: satisfaction with searching

Description: this category contains nodes describing satisfaction with the way the search went. It includes any problems encountered (dissatisfaction) and why the student was satisfied (Figure 5).

This category revolves around whether students have enough information (right level or quantity) to move on to something else. Generally students were satisfied at the point where they could debate a point or to back up some feature of their assignment – but they found it hard to specify quantity:

> I don't know it comes from guess work I suppose. If you've got five to ten pieces that you're quite happy with then you move on. Sometimes you can have two or three pieces and you

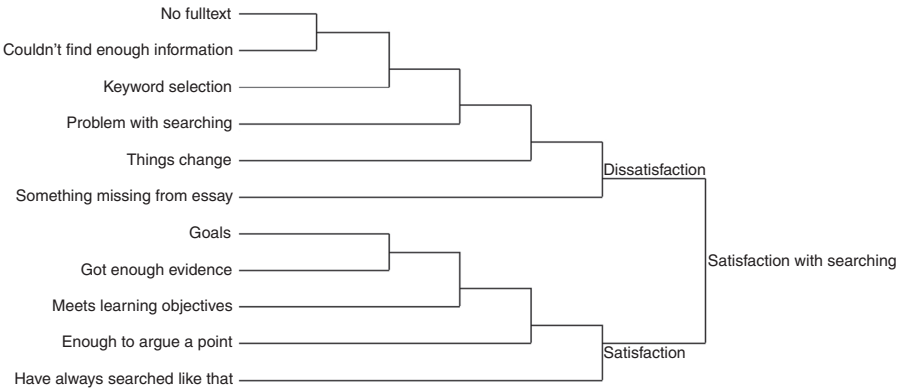

Figure 5.
Dendrogram of the nodal structure within the category for "satisfaction with searching"

> think "That's great, that's all I need" and then move on. It just depends on how much information that you pick up from each search (Student L-1).

There was a range of specific issues that created dissatisfaction with searches, although three students cited not getting fulltext as a key factor. For example:

> Interviewer: Any particular problems you encounter as you go along?
>
> K-1: Only that it gives you literature that you want and then you can't actually get it.
>
> Interviewer: So access to the articles?
>
> K-1: Yeah. You need a password or something.
>
> Interviewer: And how do you cope with that?
>
> K-1: Just find another one.
>
> Interviewer: You just ignore it at that point?
>
> K-1: Yeah (Student K-1).

Other issues of dissatisfaction focused on insufficient information or problems with the search. As such satisfaction can be seen to be getting the right information at the right time, but how much is needed to reach this point is ambiguous.

Category 6: search strategy

Description: the "Search strategy" category concentrates on the critical incident and how the student performed the search. It includes both what they did first, and how they followed up the search. It does include the specifics of what sources were used other than if clarification was sought from other individuals (Figure 6). This differs from the "Sources used" category in this respect.

There was no set pattern across the responses in terms of literature searching. Some students started with a computer search; others read around first or checked the reading list, whilst others wanted some guidance that what they thought they were looking for was correct. Some students did not specify any follow up – usually sticking with searching online. In general for those students who had not started online the follow up was to do this, but there was no consistent approach between all the students.

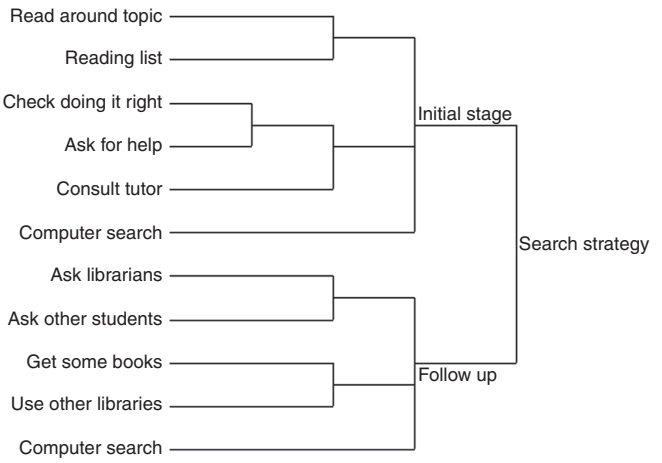

Figure 6.
Dendrogram of the nodal structure within the category for "search strategy"

For example G-MSc and I-1 both followed up with computer searches, but started their search in a different way:

> So my main aim was basically to start reading literature around that topic which then focussed me more on what I needed to find.
>
> Then I went onto the computer and library databases and obviously spoke to the librarians for support (Student G-MSc).
>
> […] I always check with the tutor if this is appropriate, because I don't want to go and research this big project if it's not relevant to the work.
>
> […] then I go to the library and research and see if there is enough information available. I go on the digital library and check on the official websites like NHS and directgov and Department of Health something reliable (Student I-1).

Many students started their search online (as typified by L-3), although S-CPD asked for help from library staff before starting her search:

> Mine was basically computer searching. I'd use Google Scholar and cross reference that with Anglia Ruskin's OPAC to see […] if I look for journals I go on Google first as it gave me the wider options then I'd look for those journals I thought were of use in the OPAC to see if I could obtain them first (Student L-3).
>
> […] the first thing I would do would be to ask for some help as to how to do it. I know there is CINAHL and MEDLINE but I'd need someone to tell me if I'm going for fulltext which ones I can get off the computer and which ones I couldn't, if I had to pay for them, that sort of thing (Student S-CPD).

Overall, there was no clear set method or pattern behind commencing a literature search or following it up and this must be taken into account during information skills training.

Category 7: sources used

Description: this category includes the places students look for information and is grouped into: physical sources, specific internet sites, people, and named subscribed sources (Figure 7).

This category shows that there are many different sources that students use to find information. All 11 students used some physical sources and subscribed resources; whilst all except student M-2 stated they used the internet, and only students L-3 and L-1 did not use other people as sources. Indeed student L-1 remarked that she did not consult fellow students in case they stole her ideas.

For physical sources the use of reference lists of journal articles was often cited as a way to find additional information:

> Yeah I do use them actually. I will go and search for them yeah I do tend to use them because then it starts getting my mind thinking about other things that might be in there and I have found some of them to be really useful (Student M-2).

Otherwise students confirm use of books and journals as their primary targets for information.

In terms of internet use, students tended to emphasise the need to find reliable sites to obtain information or to find something specific:

> […] NHS website, Department of Health, basically there are websites that are "dotgov" that are reliable (Student I-1).
>
> I tend to go to ones that are quite specific. For instance Diabetes UK and try and keep them reliable. The ones where you know the source is OK to use (Student V-2).

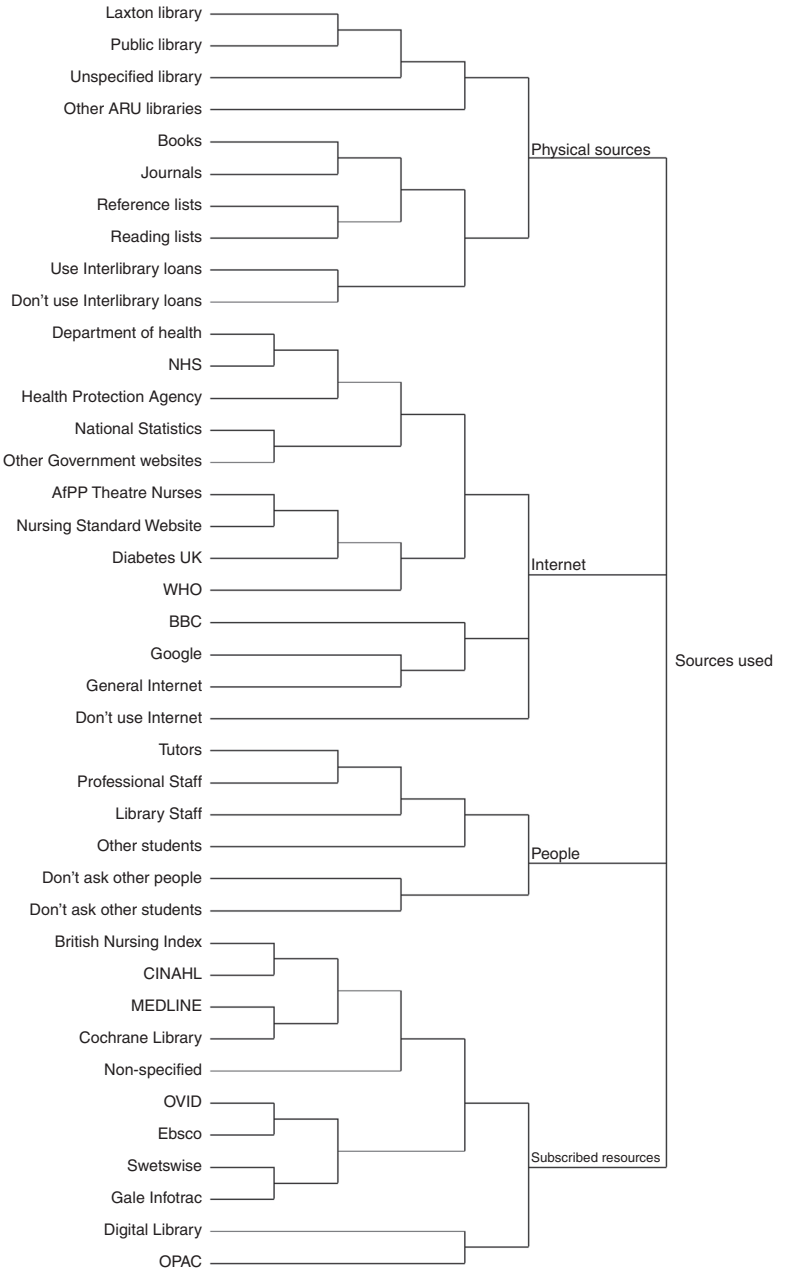

Figure 7.
Dendrogram of the nodal structure within the category for "sources used"

Students appeared keen to not remark that they did a general internet search without some consideration of the consequences of their actions.

The use of the internet led into discussion of databases, indexes, and journal packages that were purchased by the library or were linked to via the library web site.

Some students were keen to state which specific databases they used although in some cases they were unsure as to the exact name of these specific resources:

> I used Swetswise, and is it Gale Infotrac? There are some for different modules aren't there? (Student L-3).

> I know there is CINAHL and MEDLINE but I'd need someone to tell me if I'm going for fulltext which ones I can get off the computer and which ones I couldn't (Student S-CPD).

Other students confirmed they used the cross-searching facility within the Digital Library web pages which uses similar databases and journal packages, but does not necessitate any need for the student remembering the names of each one:

> I use several at a time, because it depends on what you want. You look down at the drop down list and some are listed in general nursing and I pick two or three databases out of that. Or I might change it if I wanted say critical care nursing or something like that from the list or if you want diabetes because if you change then the database list changes as well (Student E-3).

> Interviewer: Do you look at any specific databases?

> L-1: No I just tick them all.

> Interviewer: So you just use the functionality of the digital library itself?

> L-1: That's right (Student L-1).

The data shows that the students here want to show some knowledge of a thought process involved in their database searching rather than a "gung-ho" or "quick and dirty" approach.

The final category in this section is the use of other people as a source but for differing reasons. Student D-2 wanted confirmation from a specialist in the field that what she was doing was correct:

> I went and spoke to the nurse, the specialist nurse over at the hospital. I wrote an email to her and got an appointment then spent some time with her talking about the illness and patients and some research that had been done by other nurses on a similar project. I just got some feedback that way and sort of linked that all in to what I was doing (Student D-2).

Others used fellow students as sources in a collaborative approach to information gathering:

> Sometimes I consult with the other students like I find out about the possibility of signing myself up to the Postgraduate library from one of the students and we sometimes consult yes, and I think for future assignments it would be nice to sit down together and talk about ideas and prepare things in one go brainstorm into the discussion (Student I-1).

This category shows that other people are part of a wide range of sources that students use for information seeking. Students did not confine themselves to one method of information seeking, rather they utilised a selection of differing sources in the hope of obtaining the right information for their particular task.

Discussion

The qualitative and quantitative findings are discussed separately before considering how they relate to each other.

Qualitative

It was clear that students just wanted to find something that would help get them started, and then wanted more quantity later on. After determining the information

need they attained their "comfort level" (Zach, 2005) by locating a few key references that gave enough information to start with whilst nearer the end of the assignment the emphasis switched to getting more sources, in line with MacDonald *et al.* (2011), Prabha *et al.* (2007) and Zach (2005). This notion of "just enough" to start followed by "plenty to finish" approximates to Simon's (1956) satisficing/optimising theory. What appears to be happening here is that students' "satisfice" at the start of the assignment then switch to "optimizing" at the end, in part due to a perception of needing a ratio of one reference per 100 words. The notion of dynamism throughout the search process has been found in relevance judgments, but in those cases users become more discerning, not less so (Taylor, 2012).

Students' confidence levels using the library resources did not appear to be linearly progressive through the duration of the course. Those on long courses, gain confidence between Year 1 and Year 2; and then lose confidence between Year 2 and Year 3. This signals the need for on-going learning support to help students develop their skills over the duration of a course (Cole and Kelsey, 2004); along with a recognition that confidence is situation specific (Elmborg, 2006; Cool, 2001). Thus information literacy development over time may be better thought of as containing peaks and troughs dependent on the situation. Other researchers also support "tailoring" information literacy instruction across the course or in line with the situation (Detlor *et al.*, 2011; Dunaway and Orblych, 2011).

Research into the concept of relevance has found it to be a multi-dimensional phenomenon which evolves along with the user's understanding of the topic being researched (Dirndorfer-Anderson, 2005); and users judge more information as "partially relevant" during the process of new information generation (Spink *et al.*, 1998). Here relevance was incorporated into a concept of pertinence relating to that which has relevance to the matter at that moment in time (more akin to Schamber *et al.*, 1990 view). Although many elements of journal articles were identified by the students as having some level of pertinence (date, title, relevance bar), it was the availability of the full text that was clearly the most important. Previous research has shown that the availability of the full text document has a bearing in terms of judging relevancy, but not impacting as a factor in its own right (Vakkari and Hakala, 2000). The idea that pertinence is linked to convenience and that items become more pertinent the more convenient they are has, however been found elsewhere (Connaway *et al.*, 2011; Urquhart *et al.*, 2003b). If students are ignoring articles that they believe are not available in their full format, then journals that are not accessible via the institution or are not freely available will likely be utilised less. This has clear implications for student learning. Thus Steinerová's (2008) conclusion that relevance is linked to "value", "utility", and "importance" is diluted by the convenience of availability when it is viewed in terms of pertinence.

Students tend to do several different searches in the course of their information seeking to find the "right" information for their assignment. Whether it is changing the focus from book to journals (or vice-versa) or a change of keywords the revision is done in an attempt to improve the search. Previous research suggests that amongst health care practitioners electronic searching skills are poor (Koivunen *et al.*, 2010; Morris-Docker *et al.*, 2004). In addition nurses have been found to adopt a disordered approach to searching (Roberts, 2004). However, the Foster model does stress that searching may start with any of the core processes of opening, orientation, or consolidation.

The point at which the search was considered a success was when "satisfaction" was reached, but students found the concept hard to quantify. It is inherently linked to

other aspects of information seeking (particularly revising a search, pertinence, and amount of information) and dependent on the specific needs of the student at that moment in time. Thus the amount of information that creates a "satisfaction" level (satisfices) is situation specific (Simon, 1956). Dissatisfaction is multi-faceted with "inconvenience", "not enough information", and "search is too difficult" (all these aspects found elsewhere; Prabha *et al.*, 2007). Satisfaction then is a dynamic, situation-specific component that determines the stopping point of the search process.

There was no consistent approach in a students' search strategy. Computer searching was required, but not necessarily the first thing that was done. Elements of needing to orient themselves (reading around, familiarising) before commencing more detailed searching (elsewhere termed "discovering vocabulary"; Duncan and Holtslander, 2012) were evident but not universal. The idea that students utilise a "shotgun" approach to searching (Roberts, 2004) and that the search is often lacking in detail and non-linear (Haines *et al.*, 2010; Koivunen *et al.*, 2010; Verhoeven *et al.*, 2009) may be due to differing levels of confidence or the choice of sources or choice of the starting "core process" (Foster and Urquhart, 2012). Alternatively, as the students were describing different critical incidents the nature of the particular assignment may impact on the type of search strategy employed. Information skills training should be flexible and sensitive to specific needs and situations.

There was a diverse range of information sources used by the students, but in general they utilised a considered approach to searching – they were not "gung ho". This range of sources was used to try and obtain the right information for a particular task as found elsewhere (Urquhart *et al.*, 2003b, 2004). All students in this research used physical sources (reference/reading lists, books, journals) and subscribed resources (databases), with books and journals the primary targets. Other people were also heavily consulted in line with previous research on nurses and nursing students (Dee and Stanley, 2005; Spenceley *et al.*, 2008; O'Leary and Mhaolrunaigh, 2012). The heavy reliance on informal sources appears to be counter to the notion of evidence-based practice, but it depends on what information is being sought and how it is used. Getting help orientating oneself to the task at hand before starting a search or obtaining confirmation that what has been found is "good" do not in themselves impede evidence-based practice if it is the research evidence that is used. Students' poor recollection of the names of bibliographic databases may be in part due to the use of the Digital Library which encourages cross-searching of multiple databases as well as the use of "simple" search techniques. This inability to remember the names of specific bibliographic databases is a phenomenon also found in the JUSTEIS project (Spink *et al.*, 2003, p. 119).

The qualitative results concentrated on determining the "mechanics" of the search process itself, without assumptions about expectations from the quantitative findings. The key points were:

- Students satisfice first, then try to optimise later.
- Students' information literacy development over time is non-linear.
- The more accessible the information is, the more pertinent it becomes.
- Students revise searches to find the "right" information.
- Satisfaction/dissatisfaction is at the end of each search process.
- There is no standard approach to the search strategy which is contingent on the situation.

- A diverse range of information sources are used to find the right information for a particular aspect of the search.

These stages were placed into a task-based searching flow-chart (based on Bystrom and Jarvelin, 1995) to show how these key points influence particular stages of the process. The initial task and search strategy employed is dependent on the situation the student finds themselves in (how much do they already know? what stage of the course are they at? what type of assignment is it?). The sources chosen for the search mould the search strategy. Situation also affects the results and the satisfaction with these results which are influenced by the accessibility of the information which is contained within the criteria for pertinence. Revising the search emanates from dissatisfaction with the results and may impact on the sources used in the new search strategy. The flow chart was further developed after consideration of the quantitative findings (Figure 10).

Quantitative

Initial analysis showed clear links between particular micro-processes with ILSE levels and different learning styles (Stokes and Urquhart, 2011). Intermediate ILSE students are linked to monitoring and identifying the shape of existing research suggesting they would prefer (due to their lack of confidence) to stick with what they already know rather than look for additional information; and need to confirm that what they have got is worthwhile. Advanced ILSE students are more likely to work out what they need to find (defining the problem) then to work out search strategies by identifying and using keywords in their search. Being prepared to build and adapt the search as it progresses (chaining) and an ability to define boundaries during the search process (refining) are indicative of a higher confidence level. In addition undertaking sifting suggests a preparedness to determine relevancy as the search progresses; and knowing enough indicates these students are better able to decide when to stop searching.

Deep learners were linked to exploring breadth, browsing, and sifting supporting the notion of being willing to explore, cruise around where the search takes them, whilst ensuring they do not meander too far from their initial goal (in line with Heinstrom's, 2003 study). Networking fits into this notion of finding out as much as possible from different sources. Identifying keywords would more likely be expected to be linked to strategic learners as they would want to find suitable search terms. It is possible that deep learners need some element of structure to "kick start" their search before they dig and delve around.

Strategic learners links to defining the problem and refining are to be expected as this shows a need for a more structured approach to the ISB process both at the beginning and during the search process. Additionally, using the right sources (keyword searching), judging the relevance of materials during the search (sifting), the relationship of this information with other sources (identifying the shape of existing research), and being clear of an end point of the search (knowing enough) are clearly appropriate processes that would be undertaken by strategic learners. Chancing and collecting only fit with this group if they felt that this would assist with future searches (although "later use" was not defined in the questionnaire). These two micro-processes may be considered to be on the "periphery" of what strategic learners do. Verifying is also linked to strategic learners and fits if viewed in terms of confirming that accurate information is located. Verifying could also be linked with collecting in terms of wanting to keep items in order to check their accuracy (verify) at a later date.

Surface learners were linked to networking and reviewing suggesting these students prefer to ask others and to stick with what they have found before rather than search either for themselves or afresh; which ties in with the intermediate ILSE's groups links to monitoring and identifying the shape of existing research.

Linking in personality traits

All types of data analysis showed a strong link between browsing and openness, and in most cases with a deep learning style. This would be expected as it ties a willingness to explore with an openness to experience and is in line with previous research (Heinstrom, 2003; Halder *et al*., 2010; Vermetten *et al*., 2001; Zhang, 2003). Openness was negatively associated with defining the problem suggesting a lack of focus and a "see where the search takes them" attitude which ties in with students who do prefer to browse, again in line with previous research (Heinstrom, 2003; Halder *et al*., 2010). Vilar and Žumer (2008) found two clusters among 61 participants, one less focused on a single goal, preferring group work and collaboration, and holistic in approach, the other cluster more focused on a single goal, and individualistic.

Reviewing was top ranked for intermediate ILSE and the agreeableness trait, and had high odds of being performed by surface learners. However although some association between reviewing and surface learners could be muted here (as surface learners tend to have lower ILSE levels), surface learners had low scores for agreeableness thus partially contradicting the association. Surface learners, however would tend to have less to review so may believe they do more of it, or simply that they need to check as they go along.

Willingness to perform collecting – shown from the anomaly data analysis and the students disagreeing with the micro-process – fits with the ability to exhibit a patient approach. This is the sort of aspect found in more agreeable individuals who exhibit diverse searching patterns (found in other personality research; Halder *et al*., 2010). The ranking and regression analysis also identified a negative association between agreeableness with both picture building and identifying the shape of existing research which concurs with a patient, calm approach to information seeking indicative of agreeable individuals (Heinstrom, 2003). Agreeableness was negatively linked to incorporation and chaining suggesting this type of student prefers to complete a search before checking what they have and they tend not to use reference lists from retrieved sources as information sources. This does seem to indicate a lower level of ILSE and fit with surface learners.

Conscientiousness was linked to sifting and verifying which was to be expected as students with high levels of this trait would be projected to want to ensure that they are progressing well during their search and that the information they have found is accurate (Heinstrom, 2003). Both of these micro-processes were strongly linked with strategic learners suggesting that conscientious students search strategically. There was a negative association between conscientiousness and chancing and thus students who prefer to structure a search and define boundaries might avoid doing this (Kwon and Song, 2011). A conscientious approach has also been linked to a desire to achieve (Zhang, 2003), which if chancing was felt to be wasting time would not be performed by students high on this trait. The links here are not, however clear cut as strategic learners have higher odds of performing chancing, but they also have the highest mean score for conscientiousness (table). This may indicate a manifestation of the evolving search process, or that there are two types of strategic learner, one searching in a structured way, and one prepared for "happy chancing" (serendipity) to save time, possibly.

Extraversion and exploring breadth were linked with deep learning which fits the profile of preferring to browse around, and this inability to use a systematic method of studying by extravert students has been found elsewhere (Kwon and Song, 2011). Thus deep learners who are more extravert are likely to be exploring breadth and networking (Kwon and Song, 2011; Heinstrom, 2003). Extraversion in this study is also linked to the surface learner type, as is networking and the surface learner type also uses monitoring – consulting documents that are easy (perceptually) to access. Thus surface learners who are more extravert do both networking and monitoring. Incorporating, which was linked to extraversion also seems to describe students wanting to stop, to bring it all together.

Emotional stability was linked to identifying the shape of existing research which concerns judging relevance of information in relationship to other sources, and a lack of this skill has been found in individuals with lower emotional stability (greater neuroticism) (Heinstrom, 2003). This micro-process and emotional stability were linked with strategic learners and the intermediate ILSE group further enhancing this relationship between the micro-process, personality trait and learning style. Previous research has found that highly neurotic (non-emotionally stable) individuals are "poorer" information seekers in general as they perceive more obstacles in the search process, tend to abandon searches early, and have negative feelings towards information searching (Heinstrom, 2003; Halder *et al.*, 2010).

The individual profiles formulated by adding in the micro-processes are given below, and shown schematically in Figure 8:

- Deep adventurer = deep learner, advanced ILSE, openness, browsing, chancing, identifying keywords.
- Deep identifier = deep learner, advanced ILSE, conscientiousness, sifting, defining the problem.
- Deep investigator = deep learner, advanced ILSE, extraversion, networking, exploring breadth.
- Strategic all-rounder = strategic learner, advanced ILSE, conscientiousness, sifting, verifying, chaining, keyword searching, chancing , refining, defining the problem, knowing enough.
- Strategic collector = strategic learner, intermediate ILSE, emotional stability, collecting, identifying shape of existing research.
- Surface co-ordinator = surface learner, intermediate ILSE, extraversion, networking, monitoring, incorporating.
- Surface skimmer = surface learner, intermediate ILSE, agreeableness, collecting, reviewing.

All three profiles for deep learners contain advanced ILSE, but have different personality traits and ISB micro-processes. Strategic learners are split in terms of ILSE with one profile each for advanced ILSE students and one profile for intermediate ILSE students, both of which have different personality traits and ISB micro-processes. Surface learners have two profiles, both containing intermediate ILSE, but both with different personality traits and different ISB micro-processes. Picture building is the only micro-process with no clear links and is not included.

Entwistle and Peterson (2004) contend that deep learners strive for a thorough understanding much more than strategic and surface learners, and this suggests that

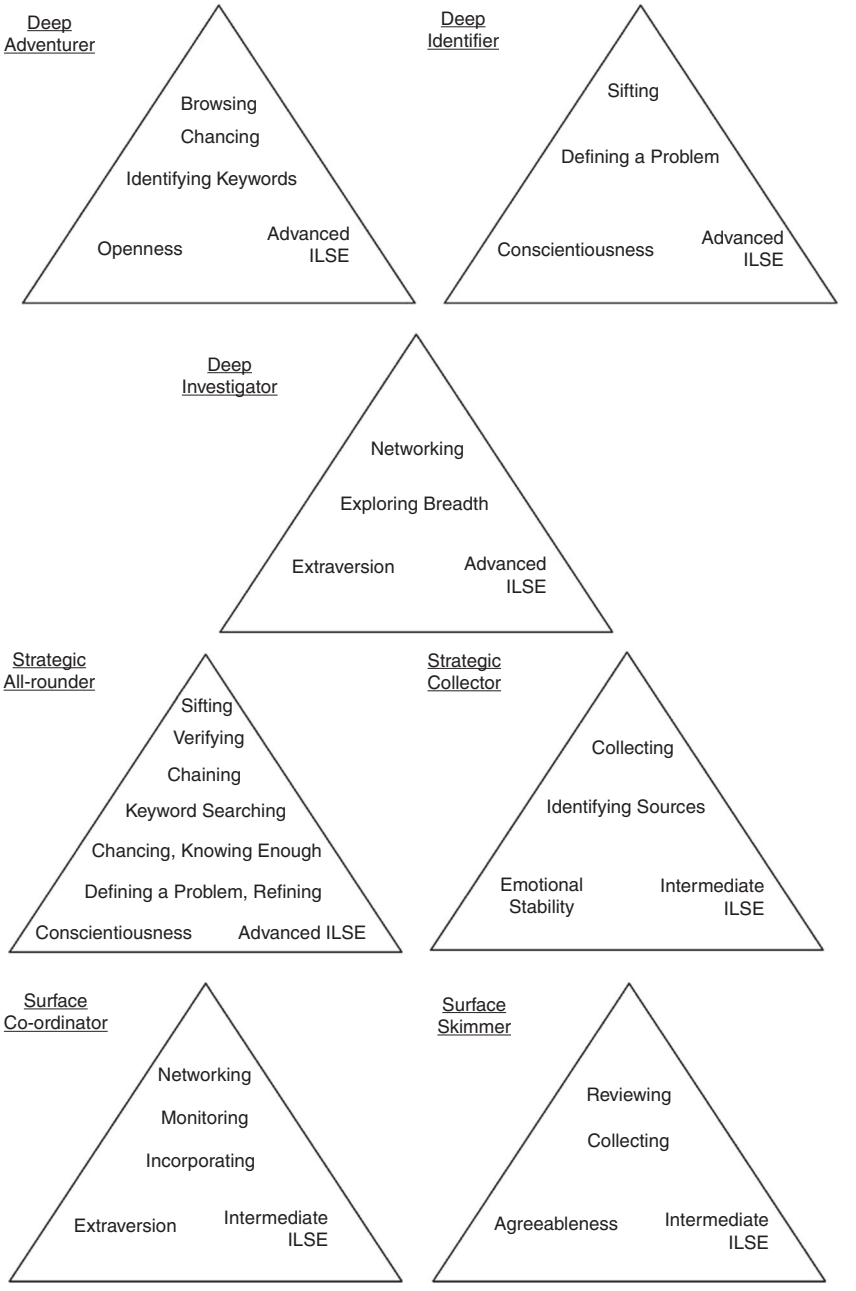

Figure 8.
The seven ISB profiles

a lower confidence level may be linked to level of understanding. They maintain a "level of understanding continuum" exists with surface learners at the low end moving through strategic learners occupying the middle ground and deep learners found at the end corresponding to a high level of understanding. This mirrors the confidence with

information literacy results which showed deep learners at the advanced end of the scale, surface learners at the intermediate end, and strategic learners again occupying the middle. By placing the relevant ISB micro-processes along the continuum (Figure 9) it becomes clear that they "fit" along different points. Some micro-processes (e.g. chancing) cross different learning styles which in turn have "blurred" edges. Only a single micro-process (networking) has strong links with both surface learners and deep learners and thus appears twice in the figure at the two poles. The personality traits in Figure 9 appear only once except for extraversion which has links to both deep learners and surface learners; in addition to the networking micro-process and thus both are placed at the poles.

Integrating qualitative and quantitative findings

The qualitative results for confidence substantiated the findings from the quantitative results that self-efficacy with information literacy does not necessarily increase as students' progress through a course. The qualitative findings highlighted the importance of "amount of information", with (mainly) different views at the beginning and end of the search. Core processes of opening, orientation and consolidation are visible, and students varied in their starting point (as would be predicted). All profiles showed some definite opening micro-processes (with the exception of deep identifiers, that focused on orientation (defining a problem) and consolidation (sifting)). The dendrogram for "amount of information" illustrated how the micro-processes were described by students: "found some core articles" (identifying shape of existing research), "piles of articles" (collecting, browsing), "happy with what I've got" (chancing, reviewing). Similar examples can be identified when students described their search strategy: "So my main aim was basically to start reading literature around that topic which then focussed me more on what I needed to find" (opening(browsing)/orientation(defining the problem)/ consolidation (refining)); "[…] I always check with the tutor if this is appropriate, because I don't want to go and research this big project if it's not relevant to the work" (start point here seems to be consolidation (refining) using expert input to save time on opening and orientation processes).

The category of "pertinence" seems to be tied in with personal judgement and perception of time available – what might count as knowing enough, as well as learning style – the differences that deep, strategic and surface learners might demonstrate. The qualitative findings illustrated both the informal approach to networking (among fellow students) (Surface Co-ordinator) and the more professional *networking* that contacted experts (Deep Investigator). Surface Co-ordinator and Deep Investigator were extravert.

Figure 9.
The five personality traits and their links with the information seeking micro-processes, learning styles and information literacy self-efficacy

From the point of view of the information professional the ideal information seeker profile might be Strategic All-rounder – conscientious, advanced ILSE, and with evidence of a range of opening, orientation, and consolidation micro-processes. From the perspective of professional practice, and the "people in practice" perspective on information literacy (Lloyd, 2012), success may be measured differently. The networking microprocess probably needs to be considered a little more carefully, as all professional nurses need to "network" in several senses of the term, and the qualitative findings on "selection of sources" demonstrated the desire by some students to discuss and exchange information in preparation for an assignment.

The information search model (Figure 10) referred to earlier was therefore enhanced to include both qualitative and quantitative findings. It shows that the situation and the individual preferred ISB profile influences the approach taken to the task (search strategy, sources used) and actions taken on the results (amount of information) and attitudes towards the results which may lead to the decision for revision of searching, or satisfaction with what has been obtained. As students do more searching, and more revision of searching, the confidence and self-efficacy levels may change and these impact on the likely micro-processes used.

Whilst this is a task-based model, it shows elements of expectancy-value beliefs (see Savolainen, 2012; Eccles and Wigfield, 2002) in which expectancies and values influence motivation in terms of performance, persistence, and choice differing from Bandura's self-efficacy which focuses on outcome expectancies (Bandura, 1997).These beliefs are contained within the situation the searcher finds themselves in which impacts on the search strategy, what to do with the results that are obtained, and whether satisfaction with the process is attained.

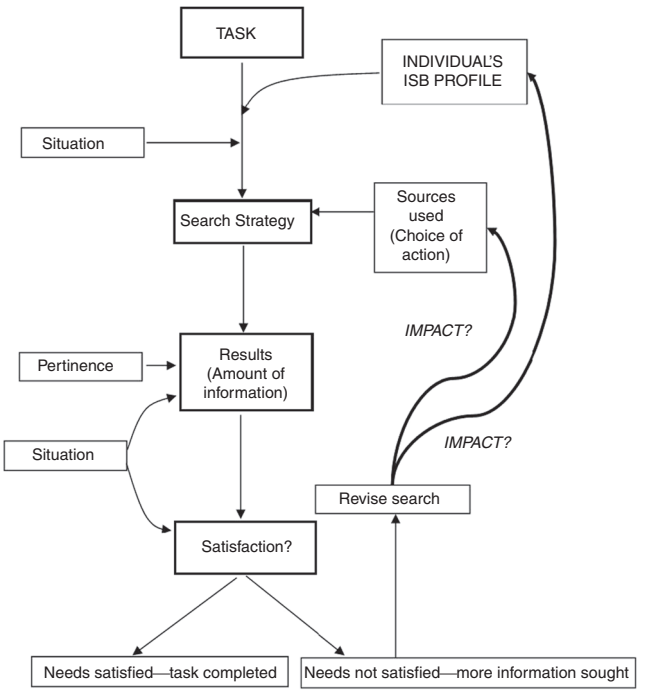

Figure 10.
The information search process including the ISB profile

Conclusion

The seven different search profiles developed need to be tested among other groups of nursing students, and students in general. Some attitudes and behaviour (e.g. towards referencing practice) could be peculiar to the institution at which the research was conducted. The qualitative data collection and analysis was approached as separately as possible from the quantitative stage of the research, to ensure that the qualitative analysis was not biased by the quantitative findings. The use of dendrograms helped to make the analysis systematic. The qualitative and quantitative findings do complement each other, and evidence for the micro-processes was found in the ways students described their searching. We have also confirmed the micro-processes for the Foster model, and stress the importance of the "verbing". The implications for information literacy programmes will be the focus of a later paper, but we note that the findings indicate that deep learning – for this group of students – may proceed in ways that have not been noted before.

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