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8. Information Problem Solving in the Bachelor of ICT

Jos van Helvoort

Introduction

Many years ago, when I was 23 years old, I was looking for a topic for my Master's thesis. As a student in Dutch literature I knew that I wanted to do something about 'reading pleasure' for students in secondary education, but I could not find a good focus. One afternoon in 1980 I visited an antiquarian bookshop in Amsterdam. While I was looking for something else my eyes fell - more or less accidentally because there were hundreds of books on the shelves - on a translation of Krathwohl's 'Taxonomy of the Affective Domain' (1971). It was exactly the right book at the right time for me. The educational theory in the book helped me to find a direction for my last assignment at university.Was I just lucky that I found the book? I don't think so. I think that I could recognize at the right time the information that I needed and to select the right book by a kind of intelligent intuition. I realized that the content was useful for the answers I was looking for. One of my questions today is whether I was also 'information literate'.

Information literacy (also referred to as the competence of 'information problem solving') is an essential set of skills for today's knowledge society in which people are confronted every day with an abundance of information on the internet and many other media (Eisenberg, 2008). Students in higher education are often faced with assignments that require them to recognize an information need, gather the relevant information, analyse and then synthesize it to formulate an adequate answer on a real-life problem (Brand-Gruwel, Wopereis, & Vermetten, 2005). During their careers the competence to solve problems with information from the internet or digital libraries will continue to be very much in demand (Weiner, 2011; Head, Van Hoeck, Eschler, & Fullerton, 2013). Searching for information, accumulating it and synthesizing it into knowledge are 'research skills' (Eisenberg, 2008) and are furthermore a condition to becoming a self-directed knowledge worker (Lloyd, 2003). Consequently, information literacy skills ('informatievaardigheden' in Dutch) have been a serious object of international research in Library and Information Science since around the year 2000 and are explicitly mentioned as one of the skills needed in the twenty-first century (Trilling & Fadel, 2009).

Because of the importance of information literacy skills for students, I conducted a comprehensive research on methods of assessing students in higher education.

When citing in APA, please refer as follows:

Van Helvoort, J. (2018). Information Problem Solving in the Bachelor of ICT. In F. Jacobs, & E. Sjoer (Eds.), *Inspired to change: A kaleidoscope of transitions in higher education*. The Hague, The Netherlands: The Hague University of Applied Sciences.

In my PhD research I described the construction, testing and evaluation of a 'scoring rubric' that can be used to measure and promote these skills (Van Helvoort, 2016; Van Helvoort, Brand-Gruwel, Huysmans, & Sjoer, 2017). A scoring rubric can be defined as a set of "criteria for rating important dimensions of performance, as well as standards of attainment for those criteria" (Jonsson & Svingby, 2007). The 'Scoring Rubric for Information Literacy' (Van Helvoort, 2016; Van Helvoort, Brand-Gruwel, Huysmans, & Sjoer, 2017) used the following seven criteria: 1) orientation on the topic, 2) reference list, 3) quality of primary sources (books, journal articles, websites, etc.), 4) in-text citations, 5) creation of new knowledge out of relevant information, 6) search terms/keywords, and 7) the use of secondary sources (search engines, bibliographic databases). These criteria refer to lower order, more operational and administrative skills (reference list, in-text citations, keywords and databases) as well as higher order thinking skills (orientation and question formulation, evaluation and selection of primary sources, creation of new knowledge). The professional behaviour and clear examples of insufficient behaviour are described for each criterion.

The case of the Bachelor of ICT

From the perspective of my PhD research, I was interested in the way that competency of information problem solving was integrated into the curriculums of the Bachelor of ICT. The Bachelor of ICT at The Hague University of Applied Sciences, where I work as a lecturer, is a broad programme with five differentiations: Software Engineering (SE), Network & Systems Engineering (NSE), Business & Management (B&M), Information Security Management (ISM) and Information & Media Studies (IMS).

Not only was I interested in information problem solving activities in the curricula but also in engaging my colleagues in integrating these IPS tasks in their curriculum. I therefore decided to design my research as a participative project. The information about the curricula was gathered by interviewing colleagues.

In this research, the seven criteria of the scoring rubric for information literacy were considered as referring to sub-skills of the constituent skill 'information problem solving', which is itself part of the broader concept of research skills (Eisenberg, 2008). The main question of the research was: Which information problem solving skills, according to the lecturers in the Bachelor of ICT, are important for their students, and which facets of information literacy should be paid extra attention?

Nine lecturers from the Bachelor of ICT program were interviewed: two each from SE, NSE, B&M and ISM and one from IMS. The interview questions were tested in a mock

interview with a SE lecturer. All interviews were taped with a memo recorder and the texts were transcribed. The content of the transcriptions was coded with ATLAS.ti with codes from a code list that was constructed beforehand.

Results

Almost all the staff members interviewed indicated that they stimulated students to retrieve theoretical information from the subject-based literature and to use that information for solving subject domain related problems. Information literacy skills are, according to the staff members, not only important in the course dedicated to the acquirement of research skills but also in other, more subject-based courses. Only the subject lecturer from SE indicated that in his field of applied sciences, information seeking does not only refer to comprehensive research. According to him, quick look-ups on the internet for instance on solving software programming errors are much more important. "In those cases, it is enough to type the error message in Google and then you can easily find some sites, for instance StackExchange; places on the internet that you often use." This lecturer from SE also indicated that information sources are often provided in the course pack and that students don't have to do the information research themselves. This is confirmed by the second SE lecturer (a professional skills lecturer), although she wishes this wasn't the case: "It seems that most of my colleagues in SE think that they can provide their students with the only right theory and that there is only one way to solve problems. I don't believe that. The world is much more complex."

All the other interviewed lecturers indicated they supported a didactic approach that asks the students to retrieve subject information themselves and to build in this manner their own knowledge (the criterion 'creation of new knowledge' in the scoring rubric). In general, the lecturers do not ask their students to use the library databases for it: in their opinion it is good enough to use Google Scholar and to recognise the original resource in the result list. One of the lecturers from B&M said: "That's the way I do it myself."

According to all the respondents, the most important sub-skills of information problem solving are:

- selecting items from a result list
- judging the information on actuality, relevance and reliability
- analyzing the information to apply it in the student's own knowledge product.

Also, the SE lecturer, whose opinion that seeking information mostly refers to quick look-ups on the internet, had the opinion that students must be able to transfer the

information that they find to other contexts. “For instance, if the student has found information on the A * algorithm in games he must be able to apply it in a planning system.”

Although all four lecturers in the differentiations NSE and B&M said that whilst they attach great value to the use of reliable information sources, they don’t ask their students to report on their search strategies (the criteria ‘search terms’ and ‘secondary resources’). They think that they can judge the quality of the search process by the judgement of the sources in the reference lists. The subject lecturers in ISM and IMS however do ask their students for a search process report. “Otherwise they don’t remember what they have been doing,” says one lecturer from IMS. The professional skills lecturer from SE doesn’t ask for a report but directly asks each student how they conducted their search.

References to information sources (in-text citations) and a reference list were considered important by almost all respondents (except again the SE subject lecturer), but the correct appliance of a citation style (APA, IEEE) was less important to the lecturers. However, only mentioning a URL in the text or reference list is not considered good enough.

All interviewed lecturers who claimed that information problem solving is important for their students do assess the quality of the information processes themselves, but it is exceptional to use a scoring list or rubric for it. One of the B&M lecturers knows that the scoring rubric for information literacy is applied in one of the B&M courses. In all other cases the judgement of the quality of the information problem solving process is implicit. In other words, no explicit judgement of the information problem solving by students (like the mentioned ‘Scoring Rubric for Information Literacy’) took place.

When they were asked which of the information problem solving skills students could improve the lecturers NSE answered that students should be taught to look further for the best primary sources. One of them expressed it this way: “This new generation of students, you’d think they are used to surfing the internet but I am sometimes so disappointed. For example when they only look at Wikipedia and do not search for more information. Why don’t they use the reference list there?” Improvements suggested by the lecturers in B&M is the attention paid to evaluation and regulation. “We ask a lot from them, but I am afraid that they stop learning after they have received the feedback and their grade. I doubt that they will do better next time.”

Conclusions

The main research question in this chapter was: Which information problem solving skills are, according to the lecturers in the Bachelor of ICT, important for their students? Selecting items from a results list and judging the information on actuality, relevance and reliability were regarded as extremely important by most of the interviewed lecturers. All these sub-skills refer to the third criterion of the scoring rubric, the quality of the primary sources. As mentioned before, one of the NSE lecturers holds the opinion that students should improve their behaviour exactly on this point. Another sub-skill that is seen as very important by the interviewees is the analysis of information to be applied in the student's own knowledge product. This refers to the fifth criterion of the rubric, the creation of new knowledge.

The quality of primary sources and the creation of new knowledge criteria both bear extra weights in the grading process with the scoring rubric. A third criterion which also bears extra weight ('orientation on the topic') was mentioned as an important sub-skill by some interviewees but not as explicitly as the other two criterions. One of the facets of information problem solving that need improvement, according to one of the lecturers, is the reflection on the whole process to stimulate the anchoring of this mode of working.

In the concept of information problem solving are higher order skills (orientation and question formulation, judging information and creation of new knowledge) distinguished from lower order skills (reference list, in-text citations, the selection of keywords and databases). Considering all results of this research, one can conclude that the importance of the higher order IPS skills – which refer to 'learning to think' (Elshout, 1990) – is recognised by most of the interviewed lecturers. The lower order skills are considered less important by most of them.

Discussion and recommendations

Research skills are an essential competence for twenty-first century professionals and solving information problems is part of it. During this research it was found that many lecturers of the Bachelor of ICT have integrated the solving of information problems in the students' learning processes. According to Healey (2005) these competences are part of 'inquiry based learning'. A research paper by Prince and Felder (2006) claims that inductive teaching methods in engineering education can also be "at least equal to, and in general more effective than, traditional deductive methods for achieving a broad range of learning outcomes."

When we overlook the results of the research in this chapter it may be concluded that most of the differentiations in the Bachelor of ICT have integrated an approach about solving information problems into their curricula. However, for the differentiation SE it would be useful to consider conducting new research about the question of whether information problem solving is indeed neglected over the whole curriculum. If so, it is recommended to investigate which courses can create assignments that challenge students to explicitly solve information problems. Total absence of these types of assignments and projects in the curriculum (except for the dedicated course about research methods) is at least worrying because of the importance of research skills.

A second recommendation for the staff of the Bachelor of ICT is to make the assessment of information literacy skills more explicit. The appliance of a scoring rubric or grading list makes the grading process – currently mostly implicit – more objective, transparent and fair for the students. It is the researcher's experience that his Scoring Rubric for Information Literacy may also function as a learning tool when it is shared with students in the classroom beforehand (Van Helvoort & Joosten, 2017)[1].

Finally, it is recommended that students are asked to describe their search process and then reflect on it. Textbox 1 shows the items that students consider when reviewing their search process. This reflection is certainly the best way for students to improve their information seeking behaviour (Webber & Johnston, 2000). The researcher has developed a format for the search process reports that doesn't take too much time for the lecturers to grade and that emphasizes the learning moments for the students more than the detailed description of what the students have done step by step.

1. *Description of the original assignment*
2. *Resource for orientation and how this was used*
3. *What became the main research question?*
4. *Use of secondary resources (search engines, directories, abstract databases, portal sites) and an explanation how you found them*
5. *Systematic overview of search terms which were used*
6. *Journals*
7. *Experts*
8. *Collections physical resources*
9. *Search methods (backward chaining, forward chaining, pearl growing or database queries) + what were results?*
10. *Resources and / or search methods which were the most successful*

Textbox 1: The items for students when reviewing their search process.

1 The scoring rubric itself can be downloaded at https://tinyurl.com/y9emkvjk (Dutch version) and https://tinyurl.com/y9h9d7uz (English version).

Was the young man information literate?

When we return to the question in the lead of this chapter, one might remark that the young man was indeed competent in finding information. However, the activities in the definition of 'information problem solving' or 'information literacy' in the introduction of this chapter ("recognize an information need, gather relevant information, analyse and synthesize it to an adequate answer"), do not refer to this more intuitive manner of finding information. But there is no doubt that the ability to discover information more or less by 'accident' is also useful for professionals. The last recommendation in this chapter is therefore to extend the definition of information literacy to the recognition of 'information opportunities' in all day situations. My visit to the antiquarian bookshop in 1980 was one such situation, and listening to a news broadcast is another example. How we can teach our students to develop this ability of serendipity is an interesting question for future research.

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