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# Teacher Trainees' Information Seeking Behaviour and Their Conceptions of Information Literacy Instruction

ACADEMIC DISSERTATION
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# Abstract

Constructivist pedagogical approaches are premised on learning through independent information seeking and use, but in practice students face difficulties in achieving meaningful learning outcomes by these means. They understand research assignments as reporting exercises preferring to seek, copy and paste pieces of information. While practising teachers understand the importance of information seeking and use for learning, they have only vague notions of and underdeveloped strategies for information literacy instruction. Teacher education is not explicitly preparing teacher trainees for the task. Neither is there much research-based knowledge about teacher trainees' conceptions of information literacy instruction.

The overarching goal of the present thesis was to find out how teacher trainees' own experiences of seeking and using information in lesson planning are related to their conceptions of information literacy instruction. The empirical data were collected by semi-structured interviews from 39 Finnish teacher trainees in 2007–2008 and analysed thematically. The teacher trainees accessed in a variety of ways a diversity of information channels and sources in lesson planning. The Web complemented teachers' conventional information channels. Some of the teacher trainees' methods of acquisition were active and goal-directed, but others passive and serendipitous. The teacher trainees conceptualized their experiences only superficially for information literacy instruction, and most did not find their advanced information literacy skills transferable to information literacy instruction. They suggested procedures to demonstrate the use of basic information literacy skills or identified practical problems in implementing learning assignments using the Web. The teacher trainees own experiences alone were insufficient for developing sound strategies of information literacy instruction. The findings suggest that practising teachers' and teacher trainees' problems with information literacy instruction originate from the lack of pedagogic training relevant in the new information environment.

# Acknowledgements

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In Tampere, Finland 28.6.2013
Mikko Tanni

# List of original publications

Study I: Tanni M., Sormunen E. 2008. A critical review of research on information behavior in assigned learning tasks. *Journal of Documentation*, 64(6), pp. 893–914.

Study II: Tanni M., Sormunen E., Syvänen A. 2008. Prospective history teachers' information behaviour in lesson planning. *Information Research*, 13(4). Available from http://informationr.net/ir/

Study III: Tanni, M. 2012. Teacher trainees' information acquisition in lesson planning. *Information Research*, 17(3). Available from http://informationr.net/ir/

Study IV: Tanni, M. 2010. Teacher trainees of the Internet age – changing conceptions of information literacy instruction? In A. Lloyd & S. Talja (Eds.) *Practising Information Literacy: Bringing theories of learning, practice and information literacy together* (pp. 189–210). Cambridge: Woodhead.

# Table of Contents

# 1. Introduction

## 1.1 Motivation of the thesis

The widespread adoption of the new information and communication technologies has transformed the media and information environment available in school education. The technologies – among them the World Wide Web (the Web, from now on) – have not only increased the quantity of information available but also brought fundamental changes in the ways of seeking and using information. The Web has become an important information resource in teaching and learning by complementing, extending and sometimes by replacing traditional educational materials. (Bilal & Kirby 2002; Kuiper, Volman & Terwel 2005; 2008; Limberg & Alexandersson 2010.)

The new information environment can even be seen as motivating changes in the very basic practices of schooling by transforming the conditions for, the ways of, the goals and content of teaching and learning. The new conditions for information seeking hold promise to facilitate constructivist pedagogical approaches emphasizing students' active role in knowledge acquisition through independent information seeking and use. These approaches aim at internalized skills and knowledge that is transferable from one context to another. Achieving these learning goals is, however, conditional to teachers' ability to successfully encourage the students to use the Web in ways that would support learning. (Kuhlthau, Maniotes & Caspari 2007; Kuiper *et al.* 2005; Limberg & Sundin 2006; Limberg & Alexandersson 2010; Merchant & Hepworth 2002.)

The transformation of the information environment was noticed even before the advent of the Web when the growth of science and published literature along with the expansion of online information services in the 1970s gave the first boost to teaching information searching (Bourne & Hahn 2003: 392–398, 409). In the late 1980s, librarians in many countries began to argue that a new literacy was needed to access and use information sources in the ever-expanding information environment

(Kuhlthau *et al.* 2007: 77). With the development of the Web, the impact on the information environment was very much more dramatic than the preceding online information services. The result was access to the global information resources for everyone, undermining the need for libraries as mediators and gatekeepers between information seekers and information resources.

The transformations of the information environment and the conception of learning through independent information seeking have greatly motivated the on-going discussion on teaching and learning information literacy (Limberg & Sundin 2006). A contemporary understanding characterizes information literacy as the ability to seek and use information in purposeful and productive ways to carry out tasks or solve problems in situations and contexts in which information is needed (Limberg, Alexandersson, Lantz-Andersson & Folkesson 2008; Kuhlthau *et al.* 2007: 77–91; Limberg & Alexandersson 2010). Information literacy is promoted primarily as an intellectual framework, which is acted out by means of information and communication technologies. It has also been argued that information literacy should be embedded within the subject content of various disciplines and not presented as a set of generic skills that can be used regardless of the context. (Hepworth & Walton 2009: 43, 105; Limberg *et al.* 2008; Tuominen, Savolainen & Talja 2005.)

The access to the abundance of information does not in itself entail meaningful learning outcomes in school education (Alexandersson & Limberg 2003; Bilal 2004; Bilal & Kirby 2002; Fidel, Davies, Douglass, Holder, Hopkins, Kushner, Miyagishima & Toney 1999; Hultgren & Limberg 2003; Kuiper *et al.* 2005; McGregor & Streitenberger 2004; McGregor & Williamson 2005). There is evidence that the new technical tools for accessing information have only further encouraged students in seeking pieces of factual information rather than the understanding of complex issues (Limberg *et al.* 2008). Research findings suggest that teachers may recognize the importance of various information literacy concepts as learning goals, but they seldom demonstrate concrete, pedagogically solid strategies in information literacy instruction (Limberg & Folkesson 2006; Limberg & Sundin 2006; Williams & Wavell 2007). Even subject teachers typically disregard content and focus on various procedures for using technical tools and carrying out assignments (Limberg *et al.* 2008; Limberg & Sundin 2006). Their understanding of students' information seeking for learning assignments can be

quite naïve, and their learning assignments vague, extensive and with a deadline that leaves little encouragement for creative thinking (Hongisto & Sormunen 2010; Hultgren & Limberg 2003; Merchant & Hepworth 2002).

Teacher education is in the key role for developing the professions' answers to the present pedagogic challenges. Particularly in a country like Finland, without a strong tradition of school librarianship, teachers are primarily responsible for information literacy instruction, unlike in many other countries (*cf., e.g.*, Probert 2009). Finland has received considerable recognition for its success in PISA[1]-testing, which is generally understood as being due to high quality academic teacher training. Information literacy learning goals are considered to some extent in the *National Core Curriculum for Basic Education*[2]. The problems related to information literacy instruction have not been unravelled in Finnish schools or tackled by teacher educators, though. Finnish teacher educators prefer a pedagogic approach according to which teachers' professional skills develop from personal experience, in reflection with novel pedagogical theories, into personal theories applicable in practice (Kohonen 2010). However, teacher educators typically assume that teacher trainees can transfer their own information literacy into workable classroom strategies without being given the appropriate scaffolding for doing so (Asselin & Doiron 2003; Branch 2003; Hinchliffe 2003; Moore 2002).

Practising teachers in general belong to a generation that adopted the new information technologies during their adult life (Lankshear & Knobel 2003: 32–33, 59–62). Arguably then, teacher trainees, by being younger than practising teachers, might show more promise in understanding the changes in the information environment, and thus develop more up-to-date conceptions of information literacy instruction. A significant issue, therefore, in teacher education is teacher trainees' understanding of the challenges of information literacy instruction in this new environment and their ideas for practical solutions to address various issues in students' information behaviour. A more basic issue is, however, teacher trainees' own information seeking and use in the new information environment.

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[1] OECD Programme for International Student Assessment (http://www.oecd.org/pisa/).

[2] The Finnish National Board of Education states in the *National Core Curriculum for Basic Education* that schools should be equipped to support pupils' development into members of the information society: provide opportunities to use the new information and communication technologies and instruct pupils in using the technologies for various purposes including information acquisition, assessment and management (FNBE 2004: 16, 38, 41).

## 1.2 Areas of contribution

The present thesis encompasses three research areas. The first is students carrying out learning assignments, which constitutes the background for the thesis, but it is not empirically addressed. Notable, well-known contributions to the area are Kuhlthau's (2004) Information Search Process -model, Eisenberg's (2008) Big6 -model and Limberg's (1998) doctoral thesis on students' information seeking and learning. The second relevant research area is (subject) teacher trainees' information seeking and use in lesson planning, which lacks notable direct contributions. A related contribution is Lawley's (2011) doctoral thesis on teachers' content selection from a (particular) digital library to lesson plans. The third research area is teacher trainees' conceptions of information literacy instruction, also without notable direct contributions. A contribution to a closely associated area is the IDOL-project conducted by Limberg & Folkesson (2006), which scrutinized (practising) teachers' ways of experiencing and conceptualizing teaching information seeking.

The empirical goal of the present thesis is to contribute to the two bodies of research to elaborate the (potential) interplay between (1) teacher trainees' information seeking and use behaviour (2) and their conceptions of information literacy instruction. The theoretical goal of the thesis is to contribute to task-based information seeking and retrieval research. The thesis also seeks practical contributions to teacher education by giving an empirical description of teacher trainees' conceptions in a case where they are not given scaffolding for information literacy instruction.

The concept of task is central to the present thesis. From early on in the research project, learning assignments were considered as the teacher's instructional instrument to focus on, and they were conceptualized as information intensive tasks (see Limberg 2007; Byström & Hansen 2005). The task-based approach can develop shared conceptual frameworks with research on learner-centred instructional methods and open up the insufficiently explored research area for systematic analysis both within information seeking and retrieval research and educational research, where information seeking is seldom analysed in detail. Specifically, inquiry-learning assignments are considered as the context for students' information seeking and use, wherein information literacy instruction is embedded as a distinct learning goal to subject knowledge content. Teacher trainees' ways of information

seeking and use are addressed in lesson planning, which is a central teacher's task to which there has seldom been devoted attention in information seeking and retrieval research.

With these constraints set for the present thesis, individual psychological characteristics are not considered, although they have been shown to contribute to students' information behaviour in performing learning assignments (see *e.g.*, Ford 2004; Heinström 2002), and they lie behind teacher trainees' decisions as well. As teacher trainees' conceptions of information literacy instruction are considered in the confines of a specific type of learning assignments, the thesis does not consider any broader goals of information literacy education or various other pedagogical goals laid down in national standards or curricula or as adopted locally.

## 1.3 Research questions

The principal research goal of the present dissertation is to find out how teacher trainees' ways to acquire and use information for a work task are related to their conceptions of information literacy instruction. To attain this goal, the present thesis seeks answers to the following research questions:

RQ1: What are the key issues in designing information literacy learning assignments to encourage students to engage in inquiry learning in schools? (Study I)

RQ2: How do teacher trainees acquire and use information in lesson planning? (Study II and III)

RQ3: How do teacher trainees exploit their own experiences of information seeking and use in their conceptions of information literacy instruction? (Study IV)

The conceptual framework implied in these questions will be elaborated on in Chapter 2.6.

## 1.4 Overview of the dissertation project

The first paper published in the dissertation project (Study I) comprises a critical literature review of learning related information seeking and retrieval research. Study I stemmed from the common empirical observation that plagiarism – copying and pasting from the Web – is a major problem characterizing many students' information use for school assignments. The practical goal motivating Study I was to understand the issues relating to designing information literacy learning assignments. The characteristics of learning assignments, which could foster students' motivation for genuine learning from information, were of particular interest. In the present thesis, Study I introduces the core pedagogic challenge of school-based information literacy instruction and teachers' role in providing the pedagogic solutions, thereby motivating research on teacher trainees. The original publication was co-authored by Eero Sormunen, who wrote the introduction and outlined the figure of a process model of students' information behaviour in assigned learning tasks.

The large body of literature available on students' information behaviour suggested various types of interventions for teachers, which motivated a change of direction in the dissertation project. As the transformations taking place in the information environment constitute a motivation underlying the present thesis, teacher trainees were adopted as the topic of empirical research for their potential to bring changes to information literacy instruction in schools. Lesson planning in subject teacher education offered a chance to address teacher trainees' information behaviour in a manageable and authentic context. Teacher's work comprises many tasks, but lesson planning was chosen, because it is among the most information intensive of teacher's tasks. It became obvious that few studies had been conducted on teacher trainees' information behaviour, their conceptions of information literacy instruction and on the ways teacher trainees capitalize on their own experiences of information acquisition and use in designing learning assignments.

An empirical case study (Study II) was launched in co-operation with the Unit for Pedagogical Studies in Subject Teacher Education in the University of Tampere, Finland, in the academic year of 2006–2007. The study plotted lesson planning as a task context of teacher trainees' information behaviour and piloted research questions, data collection and analysis methods for the following studies. The study

also introduced teacher trainees' conceptions of information literacy instruction as a research interest. The original publication credited Eero Sormunen for writing parts of the introduction and Antti Syvänen for contacting the teacher educators and organizing interviews with the teacher trainees.

Another empirical study (Study III) followed in the academic year of 2007–2008 focusing on teacher trainees' information acquisition in lesson planning and elaborating on some findings made in the pilot. The latter group of teacher trainees were approached again (Study IV) with questions addressing their reflections on their personal experiences of information acquisition and use in lesson planning and their ideas for designing learning assignments. In the present thesis, the empirical studies (II–IV) serve the purposes of demonstrating contemporary teacher trainees' information acquisition and use in lesson planning, and their conceptions of information literacy instruction, to consider their potential to bring changes into school-based information literacy instruction practices.

## 1.5 Structure of the thesis

The present thesis is structured as follows. Chapters 2 and 3 elaborate on the research design of the thesis. The former presents the conceptual framework and the latter the data collection and analysis methods.

Chapter 4 presents the key findings from the research papers. Chapter 5 comprises a discussion on the findings. Chapter 6 presents a conclusion based on the findings. The data collection instruments are provided as Appendices 1–3. The four original research papers are attached at the end of the thesis.

# 2. Developing the conceptual framework for research

## 2.1 The new literacies of the new information environment

The transformation of the information environment during the past 20 years has fundamentally changed the role of information in school education. The Web offers capabilities far beyond the print media: it is up-to-date, quick to access, ubiquitous and enormous in scope in comparison with any collection of printed information sources (Kuiper *et al.* 2005; Todd 2008). The Web and associated information technologies are in widespread use in the daily lives of young people, many of whom already have no recollection of the time before its existence. Search engines have become the primary starting point for information searching whereas library use among young people is in decline. (Hepworth & Walton 2009: 122; Todd 2008.)

The Web has not been designed for education in schools. This complicates particularly students' information seeking for learning, because much of the information on the Web exceeds their comprehension. The easy access to the Web for information by anyone also places further emphasis on the critical assessment of these sources and may invoke teachers' need to control this form for fear of exposing students to harmful information. When students were restricted to local collections, teachers could to a large extent control what was accessed. The problem was more in finding any relevant information sources for learning assignments. (Limberg & Alexandersson 2010; Kuiper *et al.* 2005.) The amount of information available necessitates selectivity to determine the most useful sources, extracting the most useful information and applying it in the most appropriate way (Merchant & Hepworth 2002). As the information seeker can no longer exhaust all available information sources, the intellectual challenge of determining what is enough information and the related experiences of anxiety and uncertainty are intensified (Kuhlthau 2004: 112, 199).

The development of the information environment has been accompanied with a plethora of competing discourses defining new literacies for the new information environment. These include but are not limited to computer literacy, media literacy, network literacy, digital literacy and information literacy. Information literacy is the discourse within the field of academic librarianship. Its origins are in library literacy and bibliographic instruction, the competences in using libraries and making informed decisions about information sources, particularly. In the present context of the technological developments, information literacy encompasses the above-mentioned new literacies. Another relevant development has been the extension of information literacy towards knowing how to use information in learning. (Bawden 2001; Limberg, Sundin & Talja 2012.)

Integral to the discourses of the new literacies is the description of a continuum of stages or a hierarchy of skills, ranging from the simple to the complex. This reflects the concept of literacy itself as a continuum from the ability to reproduce letter combinations to the higher-order cognitive skills that enable logical reasoning. Information literacy has likewise been a subject to a multitude of definitions listing the various interrelated skills that constitute the concept. These range from the practical skills for using tools, understanding their underlying concepts and, ultimately, capability for abstract thinking about information. (Bawden 2001.)

The idea that information literacy can be defined as a set of generic skills and transferred from one context to another has been criticized considerably (Limberg *et al.* 2012; Lloyd 2010: 13). While something is surely generic in acquiring information, for example, from the Web, information literacy is not reducible to simplistic procedures for navigating the Web or checklists for assessing information sources (Limberg *et al.* 2012). Influential researchers argue that information literacy is situated, and, therefore, it should be considered as an awareness of a variety of ways of understanding information seeking and use in different tasks, situations and contexts (Limberg *et al*. 2008).

## 2.2 The pedagogical challenge for information literacy instruction in schools

Empirical research on teachers' information literacy instruction shows that the Web has created a tension between the tradition of schooling and the (new) conditions for learning. The mission of schools has been to mediate a canon of knowledge and correct answers. The vast amount of information readily available from the Web have prioritized information seeking and use skills over gathering knowledge in one's mind as the object of learning. (Kuiper *et al.* 2005; Limberg *et al.* 2008.) Teachers can find themselves in the situation of being less qualified in general computer and Web skills than many of their students who have acquired their skills out-of-school, and teachers might have less authentic experiences of using the Web for their own purposes (Lankshear & Knobel 2003: 29–31, 66–69; Kuiper *et al.* 2005; 2008). Teachers, however, maintain their position over their students in transforming information into meaningful knowledge. Irrespective of students' advantages in technical skills, they still need support in using the Web in learning – which the teachers may underestimate. (Kuiper *et al.* 2005; 2008.)

Research findings show that students might exhibit strong confidence in their abilities to find information from the Web for their own purposes, but face obvious problems in achieving the goals of their learning assignments. In addition to this, they struggle particularly in researching and making evidence-based conclusions. A widespread procedure is to seek, compile and present specific, factual and supposedly "right" answers. In other words, the students seek to find, copy and paste pieces of information regardless of the goals of the learning assignment. Uncritical copying and pasting remains a ubiquitous problem in schools. Their procedures leave little time for creating researchable questions, assessing information content and constructing systematic knowledge out of acquired information. (Alexandersson & Limberg 2003; Bilal 2004; Bilal & Kirby 2002; Fidel *et al.* 1999; Hultgren & Limberg 2003; Kuiper *et al.* 2005; McGregor & Streitenberger 2004; McGregor & Williamson 2005.) The information available and the technologies for processing it only tend to further challenge them in critical evaluation and application of information in learning and problem solving and make

plagiarism easier to implement (McGregor & Williamson 2005; Williams & Wavell 2007).

Information seeking can be understood in many ways according to the different contexts and situations in which it is conducted. The literature suggests that the challenge for the school in information literacy instruction lies in establishing students' information seeking an authentic context, in which they can engage in interesting activities that encourage and facilitate independent learning. The activities constitute the framework for teaching instead of demonstrating and practising isolated information skills. (Hepworth & Walton 2009: 4, 43; Limberg & Alexandersson 2010.) Information literacy instruction embedded within a specific subject domain becomes intertwined with problem solving in that domain and, thereby, less abstract than demonstrations of individual skills in general (Hepworth & Walton 2009: 11, 105). This can be achieved by using the Web for inquiry learning, such as inquiry-, problem- and project-based learning. The Web can support active, self-directed and exploratory learning only if teachers specifically design its use for inquiry learning. In inquiry learning, information seeking is not considered an end in itself but a means for conducting an inquiry or solving a problem, as opposed to seeking information for a given question (Kuiper *et al.* 2005; Limberg & Alexandersson 2010).

Empirical research on students' ways of understanding seeking information for learning assignments suggests that many students understand inquiry learning like conventional textbook-based school assignments. The school is not considered a research environment, where genuine research questions are pursued, but one where right answers are sought, memorized and (re)presented. Many aspects of inquiry learning are in fact contradictory to the tradition of schooling. (Limberg 2007; Limberg & Alexandersson 2010.) The tendency to formulate research questions for inquiry learning as simple factual questions is learnt during the first years of school (Lundh & Limberg 2008). What educators may see as plagiarism is for students simply a reasonable extension of the widespread practice (Limberg & Alexandersson 2010).

Teachers are accustomed neither to inquiry learning nor how to support their students in information seeking and use (Kuiper *et al.* 2005; 2008). Some research findings show that teachers may be able to identify relevant information literacy learning goals (Limberg & Folkesson 2006; Williams & Wavell 2007).

Unfortunately, most of them have no concrete ideas on how to design learning assignments to engage students in genuine inquiry learning and interaction with information sources (Limberg *et al.* 2008; Limberg & Alexandersson 2010).

## 2.3 Teacher trainees' conceptions of information literacy instruction

The present thesis is concerned with teacher trainees' ideas on how information seeking and use should be taught, addressed as their conceptions of information literacy instruction. The viewpoint stems from the notion that teachers have their own theories of learning that guide them on how to instruct students (Kuhlthau *et al.* 2007: 13). Research on teachers' professional growth describes "a practical theory" as one underpinning or (even) guiding teachers' didactic practices (Kettle & Sellars 1996). An important characteristic of the in-practice theories[3] in the context of the thesis is that they are capable of being articulated, unlike tacit knowledge (Deaney, Ruthven & Hennessy 2006).

Teacher education aims to change – explicate, clarify and extend – teacher trainees' in-practice theories. A common pedagogical approach in teacher education is to present teaching as a "reflective practice". In reflection, teacher trainees make sense of and analyse a range of problems and experiences connected with teaching and learning and adapt their in-practice theories by the newly gained understandings. (Jay & Johnson 2002; Kettle & Sellars 1996; Reiman 1999.) The idea of learning through reflection was introduced to library and information sciences by Kuhlthau (2004: 13–28) to understand students' experiences of seeking information for a learning assignment. Kuhlthau *et al.* (2007: 18) have since suggested that teachers reflected on their own experiences of inquiry learning assignments to prepare themselves to instruct students going through similar learning processes.

The present thesis is specifically concerned with teacher trainees' perceptions of challenges in teaching information seeking and use and their practical ideas for

[3] Various terms are used in the literature of the concept or closely related concepts (see *e.g.*, Kettle & Sellars 1996). In the present thesis, "in-practice theory" is preferred over "practical theory" as the former expression better captures the idea of a theory underpinning a practice, whereas the latter characterizes a theory as being practical, which may seem paradoxical.

learning assignments exploiting the Web in information literacy instruction. The thesis postulates teacher trainees' reflective cycle beginning from their own information seeking and use (in lesson planning) and continuing to the design of learning assignments for information literacy instruction.

## 2.4 Pedagogical models for information literacy instruction

Qualified, trained teachers have been shown to be effective in information literacy instruction, but many teachers are not aware of didactic models they could use or simply do not understand them (Probert 2009). Two well-known models developed by library and information science researchers are applicable in information literacy instruction. The models are based on constructivist pedagogical theory and empirical research on students' information behaviour. However, the models are not widely recognized in schooling outside school librarianship.

Eisenberg (2008) describes the Big6, which offers conceptual and practical strategies for effective information literacy instruction in context. The model postulates that various information literacy skills are not isolated incidents but contextually interconnected within a process. The model describes the process consisting of a series of stages, each associated with a definite set of skills and supporting technologies. The definite skills provided by the model can be used as a curricular structure, or as a framework for a set of problem-solving skills, in contrast to lists of specific activities or outlines of isolated skills, which may encourage a lockstep strategy of problem solving. (Eisenberg 2008.)

Eisenberg (2008) argues that it is important to integrate information and technology skills instruction within the learning process to enable students to develop a meaningful sense for using technologies in ways that support learning in context. It is also equally important to address real curricular content in information literacy instruction to help students see connections between what they are learning and the curriculum. (Eisenberg 2008.)

Kuhlthau (2004) originally presented the Information Search Process -model (ISP) as a framework of intervention in library and information services. Information seeking is presented in the model as a gradual process of knowledge

construction for a clarification of uncertainty, instead of a search for one right answer to a specific question. The model describes the performance of inquiry learning assignments as a series of stages in students' interweaving thoughts, feelings and actions, which indicate the students' progress in the process. The model identifies the stages of selection and exploration, but particularly focusing a topic to find a guiding idea or central theme, as the critical turning points in the process, wherein the students need the most help. (Kuhlthau 2004: 40–51, 81–84, 89–105.)

Kuhlthau and her associates (2007) have further developed the ISP as the Guided Inquiry -approach, wherein subject area curriculum and information literacy concepts are integrated. The ISP remains as the premise for teachers' interventions into students' performance of inquiry learning assignments. Teachers engage in dialogue with the students, identify their stage in the process and guide the inquiry with well-adapted instructive interventions, offering targeted support specifically for exploration of the topic and formulation of a focus (Kuhlthau *et al.* 2007: 17). Guided inquiry offers a way of learning information literacy concepts throughout an inquiry to curricular content. It demonstrates information literacy concepts underlying a wide range of information seeking tasks in each stage of the inquiry rather than presents isolated information skills independent of content and context. (Kuhlthau *et al.* 2007: 5, 79–80.)

## 2.5 Inquiry learning assignments for information literacy

In the present thesis, learning assignments are considered as teacher-designed, learner-centred teaching and learning activities focusing on specific areas of knowledge in K-12[4] education. The scope of learning assignments range from simple exercises of finding a predetermined answer to a given question, via writing essays on the basis of (independently acquired) information sources, to complex inquiries defining and solving ill-defined problems (Gordon 1999; Kuhlthau *et al.* 2007: 17; Kuiper *et al.* 2005; Limberg & Alexandersson 2010). The present thesis focuses on information literacy instruction by learning assignments that involve

[4] While the term is not used in Finland, "K-12 education" is useful shorthand capturing both comprehensive schooling and secondary education (consisting of an upper secondary or a vocational school).

seeking, assessing and using information from a variety of information sources as a condition for learning (Alexandersson & Limberg 2010; Limberg & Sundin 2006). Learning assignments are considered as instructional tools encompassing information literacy as a sub-goal of subject teaching.

The point of departure in inquiry learning is a specified problem or scenario concerning an unfamiliar topic, which is sufficiently open-ended to allow a variety of responses or solutions by using information. The teacher designs the inquiry learning assignment, initiates the process and offers assistance in the course of the task, but students pursue relatively autonomously their own lines of investigation, which are set to take place over an extended period of time. (Gordon 1999; Kahn & O'Rourke 2005; Kuhlthau 2004: 146–147; Kuhlthau *et al.* 2007: 18.) The purpose of the learning assignment is that the students' achieve intended learning outcomes[5], explicitly expressed as learning goals, which may concern curricular subject content areas, various abilities[6] – here information literacy – or competences related to managing complex learning tasks (Limberg 2007; Limberg & Alexandersson 2010; Limberg *et al.* 2008; Limberg & Sundin 2006; McGregor & Streitenberger 2004). In performing the learning task, the students identify and define a problem, seek information sources through various information channels, analyse information and construct new meanings drawing on their existing knowledge, and present their findings as documents, oral presentations or artefacts in appropriate ways (Gordon 1999; Kahn & O'Rourke 2005; McGregor & Streitenberger 2004).

Inquiry learning assignments carry specific design requirements so that they will offer opportunities for critical thinking, problem solving and meaningful learning from information, and engage students in the process (Gordon 1999). They also require active interventions on the part of the teacher to keep the process focused on the intended learning outcomes (Kahn & O'Rourke 2005; Kuhlthau *et al.* 2007: 2–3).

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[5] Syllabi, national curricula and international documents typically specify more general intended learning outcomes than what is possible within the scope of single learning assignments (see Limberg *et al.* 2008). The distinction is vital to keep in the present thesis: the teaching and learning models such as problem- and project-based learning (see *e.g.*, Kahn & O'Rourke 2005) are applied as the curriculum, making them inapplicable in full within conventional schooling practices.

[6] McGregor and Streitenberger (2004) itemize various skills that could be included as the goals of inquiry learning assignments: generating appropriate research questions, locating information, analysing information, dealing with ambiguity, evaluating the credibility and usefulness of information, sorting and organizing information, synthesizing information and ideas into coherent products and communicating them.

## 2.6 Conceptual framework

Based on the above review, Figure 2.1 represents the conceptual framework of the present thesis. The framework depicts the primary components, specifies their relationships in context, and indicates how the research questions are related. The components directly addressed are boxed, and the black arrow indicates the relationship between two components that are explicitly scrutinized in the thesis. The greyed broken line boxes indicate contexts, which are not explicitly studied in the thesis. However, the framework depicted in the figure is not a general model: it does not represent all components, processes, outcomes or interrelationships that may belong to the new information environment.

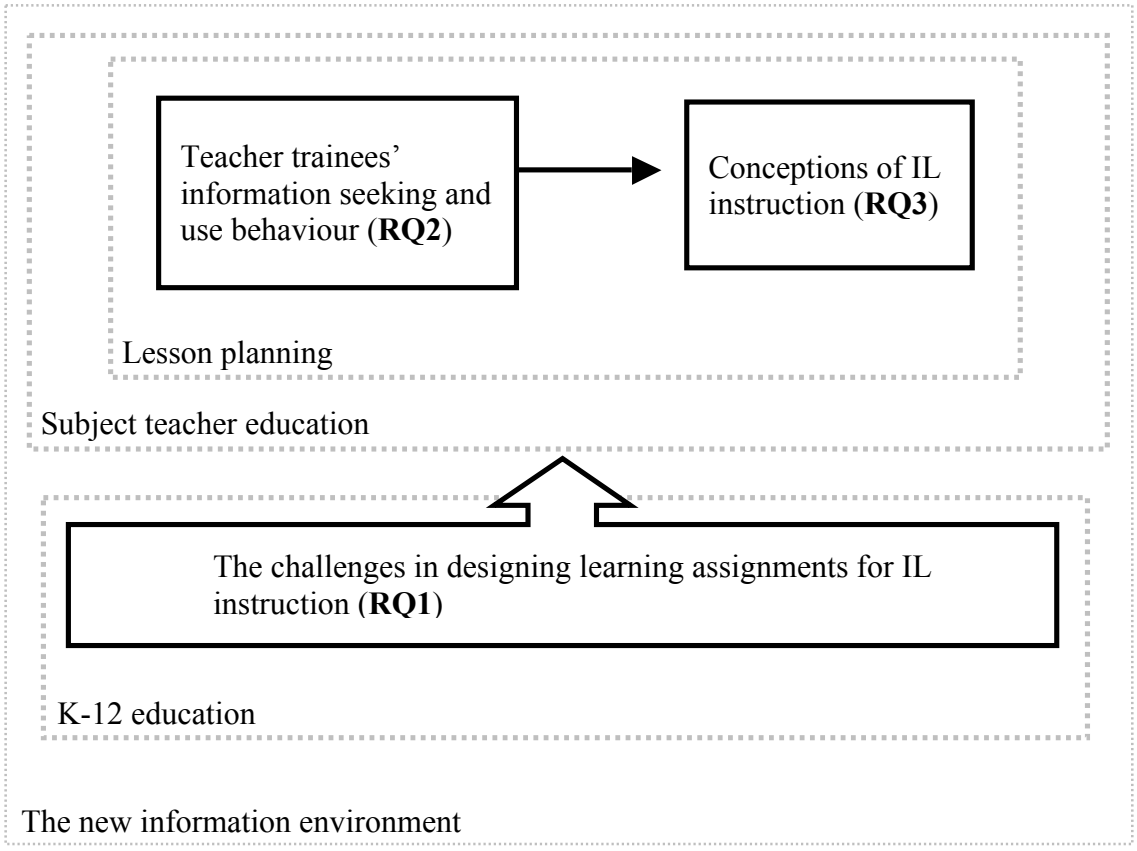


Figure 2-1 The conceptual framework of the thesis

As the figure suggests, the new information environment is the broadest context of the thesis. K-12 education and subject teacher education are embedded within this context as sub-contexts, while lesson planning is the sub-context of the latter. Subject teacher education and K-12 education are presented as being under the changes taking place in the new information environment. Lesson planning in

subject teacher education is the specific sub-context considered here. Teacher trainees' information seeking and use behaviour and their conceptions of information literacy instruction are the two components of the sub-context. The black arrow between them illustrates the potential transfer from the teacher trainees' experiences of information seeking and use to their conceptions of information literacy instruction.

The framework encompasses the implicit question if the teacher trainees' information seeking and use behaviour (RQ2) is related to their conceptions of information literacy instruction (RQ3) in ways corresponding to the challenges faced in designing learning assignments for information literacy instruction in K-12 education (RQ1). The relationship between the sub-contexts of K-12 education and subject teacher education depicted by the block arrow is considered only in the specific terms of the challenges of designing learning assignments for information literacy instruction. The thesis does not discuss how the changes in the new information environment influence K-12 education in general, or how subject teacher education has responded or should respond to the challenges emerging from the K-12 education in general. The relationship between the components of the challenges in designing learning assignments for information literacy instruction and the teacher trainees' conceptions of information literacy instruction is acknowledged, but it is not explicitly addressed in the thesis.

# 3. Data collection and analysis methods

## 3.1 Methodological approaches to information literacy research

The present thesis adopts the task-based approach to information seeking and retrieval as the framework for empirical research on teacher trainees' information behaviour. The framework postulates a first-order view on individual cognition (*i.e.*, cognitive constructivism) and tasks as the context of analysis. The approach assumes that teacher trainees plan their lessons individually and develop their personal in-practice theories. The task constitutes the context for investigating how the teacher trainees' experiences of information acquisition and use in lesson planning emerge in their ideas for learning assignments. Limberg and Sundin (2006) have argued that empirical task-based information seeking and retrieval research has potential to provide information literacy (instruction) a theoretical grounding. The task-based approach has led to practical solutions as well. Kuhlthau's (2004) research on students' information seeking in learning tasks developed into Guided Inquiry -approach for teaching.

Limberg *et al.* (2012) have elaborated three theoretical and methodological alternatives to cognitivist approaches, which contribute to the research area of information seeking and use in learning or teaching. (1) Phenomenography investigates variation in the ways of understanding information seeking and use for learning assignments (see *e.g.*, Limberg 1999a; 1999b) or information literacy instruction (see *e.g.*, Limberg & Folkesson 2006). (2) Socio-cultural approach studies information literacy as the participation in social practices through the use of (cultural) tools, including material artefacts and linguistic expressions (Limberg *et al.* 2012; Tuominen *et al.* 2005). A social practice encompasses interaction between people engaged in routinely reproduced, concrete and situated activities (Lloyd 2010: 23–24). (3) Foucauldian discourse analysis describes how specific ways of

discussing information literacy are constituted through historical formations of knowledge (Limberg *et al.* 2012).

The research methodology of the present study compares with the approaches introduced above. The first-order view on individual cognition and information behaviour is the major distinction. A phenomenographic approach would have resulted in a limited number of descriptive categories capturing variation in the content of the teacher trainees' conceptions of information literacy instruction. While Study IV describes the content of the conceptions and postulates the constructivist view on learning information literacy instruction, a cognitivist differentiation between the higher and the lower orders of information literacy is evoked to discuss the findings (*cf.*, Limberg & Folkesson 2006; Limberg 1999a). The present research project initially focused on the differences between the teacher trainees' and practicing teachers' conceptions instead on the variation in the teacher trainees' conceptions. Phenomenographic studies also tend to emphasize information use and position the research on information literacy in learning rather than in information seeking (see Bruce 2008). In task-based information seeking and retrieval research information seeking is conceptualized as constituting a subtask to the task proper (Byström & Hansen 2005). Therefore, in the present study, information literacy is contextualized in learning but not as its integral constituent. Broad definitions of information literacy can be helpful for theoretical development but difficult to operationalize for empirical research in school education.

A socio-cultural approach would have taken interest in the teacher trainees' participation in the social practice collectively instead in their performance of the single task individually. It might have emphasized their use of physical artifacts such as Websites, personal collections and personalized files[7] as cultural tools influencing lesson planning and information literacy instruction. A discourse analytic approach could have pointed out, for example, the underlying assumptions making the teacher trainees' regard some information channels and sources more authoritative than others or some modes of information acquisition more legit than others.

[7] See below for Chapter 4.3.

## 3.2 Critical literature review

The Study I synthesized information seeking and retrieval research (IS&R) conducted on students' information behaviour in assigned learning tasks. The analytic premise of the critical literature review was a process model outlined in the original research paper for information seeking and retrieval in learning tasks.

Table 3-1 Research design: Study I

| Research question | Data collection | Data source | Data analysis |
|---|---|---|---|
| What has been found in information seeking and retrieval studies conducted on students' information behaviour in assigned learning tasks? | Purposive selection. | Information seeking and retrieval research papers on learning related information behaviour. | Critical literature review. |

The literature was selected, analysed and the findings presented by the process model. In addition to the characteristics of and the relationships pertaining between the learning task and its information related subtasks, some contextual and student characteristics relating to the task characteristics were considered. Where empirical research was not available, pre-theoretical or suggested characteristics were discussed.

## 3.3 Case study

Three empirical studies were implemented in the Unit for Pedagogical Studies in Subject Teacher education, in the University of Tampere, Finland. The subject teachers participating in the case study trained in both educational science and subject-specific didactics for a research-oriented approach to teacher's work. Their training included investigating a range of problems connected with teaching and learning in reflection with novel pedagogical theories to develop their personal in-practice theories. A vital part of these studies was teaching students of various age groups in different institutions in general and vocational education in the

supervision of mentor teachers. The teacher trainees had been introduced to the use of the new information and communication technologies in teaching, but information literacy instruction was not covered by the teacher education curriculum.

The specific context for Studies II and III was the teacher trainees' lesson planning in their teaching practice period. In lesson planning, teachers translate curricular guidelines, institutional expectations and personal ambitions into guidelines for action in the classroom (John 1994). In teaching practice, the teacher trainees familiarized themselves with teacher's work by observing students and other student teachers, teaching and participating in planning and assessing teaching, including planning larger teaching units than individual lessons. In the teacher's pedagogical studies each trainee planned and delivered approximately 30 practice lessons under the supervision of a mentor teacher at a real school. In a typical scenario, a mentor teacher and a teacher trainee met and agreed on a topic on a general level, leaving the teacher trainee with a degree of freedom, within curricular restrictions, to carry out the task. The mentor teachers typically did not give strict teaching assignments with explicit requirements for the practice lessons. Sometimes teacher training institutions and school-based mentors offer instructional templates for teacher trainees laying out the structural elements of a lesson in various levels of detail and rigidity, though (John 2006; Zazkis, Liljedahl & Sinclair 2009). The teacher educators at the university gave guidance and practical instructions. They had a variety of their own practices but typically requested a schedule of the lesson in advance, observed the practice lessons on the spot and gave feedback.

The researcher approached two teacher educators to recruit the subject teacher trainees[8]. The teacher trainees taking part in these studies had majored – or were in the process of majoring – in history, social sciences, psychology and philosophy. Three empirical investigations (Studies II, III and IV) were conducted. The primary data collection method of the Studies II, III and IV was individual interviewing. Three data sets were collected in total: in April 2007 (Study II), from December

[8] Throughout the present thesis, the terms teachers and teacher trainees refer to subject teachers and trainees, excluding class teachers. In Finland, subject teachers operate in basic comprehensive education (grades 7–9), in general upper secondary education, in liberal adult education institutions or as teachers of core subjects in vocational institutions.

2007 to April 2008 (Study III), and in May 2008 (Study IV). The total number of participants was 39. All interviews were conducted in Finnish by the researcher, recorded with a laptop computer, transcribed by a professional service word-for-word, and analysed in Finnish. The present chapter summarizes the analysis procedures of each study. The reader is referred to the original research papers for more detailed accounts.

Table 3-2 Research design: Study II

| Research questions | Data collection | Data source | Data analysis |
|---|---|---|---|
| 1. What information channels and sources do teacher trainees access and utilize when seeking information for lesson plans?<br>2. What criteria do teacher trainees apply when selecting information for use in lesson planning?<br>3. What patterns can be identified in teacher trainees' information seeking in lesson planning?<br>4. For what purposes do teacher trainees use information in lesson planning?<br>5. What do teacher trainees learn about seeking and using information for lesson plans? | Semi-structured retrospective individual interviews, conducted in April 2007, and resulting in 6 hours of recorded data. | History majors (n=14) embodying 5 males and 9 females. | Inductive thematic analysis with individual respondents as the unit of analysis. |

The goal of the pilot phase (Study II) was to explore lesson planning as a context of the teacher trainees' information behaviour and to develop research questions, data collection and analysis methods for Studies III and IV. Research questions were transformed into a semi-structured interview guide (Appendix 1) that provided the researcher with the opportunity to rephrase questions if requested and the interviewees to interpret the questions in their own way. The interviews were conducted at the end of the teacher trainees' training period.

The analysis procedure sought to describe the teacher trainees' recollections about seeking and using information for lesson plans in general, dismissing individual differences. Atlas.ti qualitative data analysis software was used. The data

were unitized into statements expressing relevant and discrete ideas or conceptions. The statements were compared and then organized into groups corresponding to the research questions. Finally, a summary of the statements in each group was written.

Table 3-3 Research design: Study III

| Research questions | Data collection | Data source | Data analysis |
|---|---|---|---|
| 1. What information channels and information sources do teacher trainees use in lesson planning?<br>2. What are teacher trainees' modes of information acquisition in lesson planning? | Semi-structured retrospective individual interviews and classroom observations, conducted from December 2007 to April 2008, and resulting in 7.5 hours of recorded data. | History (n=10) and social science, psychology and philosophy majors (n=13) in two groups embodying 6 males and 17 females altogether. | Inductive thematic analysis with individual respondents as the unit of analysis. |

Study III explored the teacher trainees' information acquisition in lesson planning, meaning their use of information channels and sources and their ways of acquiring information. Retrospectively held individual interviews were the primary data collection method in which a semi-structured interview guide (Appendix 2) was used. Observation was employed as an auxiliary data collection method. The researcher attended a single practice lesson per teacher trainee and observed what information content the teacher trainee presented to the class. After the lesson, the researcher interviewed the teacher trainee. The observations were exploited to particularize questions and to ensure that all information sources observed in the class were dealt with. The interviews were conducted over a period of five months; some of the teacher trainees were interviewed in the middle of their training periods and the others at the end.

The transcripts in Finnish were analysed thematically by using HyperResearch qualitative analysis software. Boyatzis (1998: 4, 11, 16–17; 31–32) describes thematic analysis as a process of encoding (*i.e.*, classifying or categorizing) qualitative information by using explicit codes. A theme is a pattern identified in data that, at minimum, is a description and organization of an aspect of the data and, at maximum, an interpretation or an explanation of aspects of the phenomenon

under study. A theme can be manifest (*i.e.*, directly observable in data) or latent (*i.e.*, underlying the phenomenon). (Boyatzis 1998: 4, 16–17.) A code captures the essence of thematic observations as a label and a description, thereby providing a link between data and the researcher's ideas about the data (*ibid.*: 11, 31–32, 48–49). Each code covers "the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon" (*ibid.*: 63–65). In Study III, codes were assigned to semantic units varying between a few words to a few sentences in scope. A binary nominal scale was used: a code was either present or absent. The unit of analysis, the entity being analysed (*ibid.*: 62–63) and encoded, was an individual teacher trainee represented by the corresponding interview transcript.

The code development followed the hybrid approach described by Boyatzis (1998: 51–53). Previous research was consulted for ideas, but the codes were developed inductively from the data instead of being drawn from a theory or adopted from a previous study. The procedure of constant comparisons (Lincoln & Guba 1985: 339–344) was followed throughout the analysis. The data was read through with the research questions in mind and an initial set of themes was produced based on (dis)similarities identified in the data. The data was read through again case-by-case and the now emerging themes were coded present. The themes were then retrieved code-by-code and checked for consistency within each theme and for differences across the themes. Reading data within a theme emphasized the differences in the theme; reading across the themes emphasized the similarities in each theme. The descriptions of the codes were written for the maximum of differentiation: to ensure each identified pattern of data would fall under only one of the themes. The descriptions of the codes were reformulated and the codes were split or new ones added. The codes, thus, gradually tested against the data, became more discriminating and consistent. The process was concluded when the properties of the revised codes were crystallized and stabilized, and there were no anomalies left in the coding.

Table 3-4 Research design: Study IV

| Research questions | Data collection | Data source | Data analysis |
|---|---|---|---|
| 1. What challenges do teacher trainees experience in seeking and using information for lesson plans?<br>2. What experiences do teacher trainees consider transferable to teaching information seeking and use?<br>3. What challenges do teacher trainees identify in teaching information seeking and use?<br>4. What ideas do teacher trainees express for Internet-based exercises? | Semi-structured retrospective individual interviews, conducted in May 2008, and resulting in 2.5 hours of recorded data. | History (n=10) and social science, psychology and philosophy majors (n=15) in two groups embodying 6 males and 19 females. | Inductive thematic analysis with responses by individual interviewees as the unit of analysis. |

Study IV explored how the teacher trainees' conceptualize and weigh their own experiences of information seeking and use, and how they conceptualize challenges in and suggest practical solutions for teaching information seeking and use. The previous group of teacher trainees (see Study III) were re-recruited and re-interviewed at the end of their training period. A structured interview guide (Appendix 3) was used, addressing the teacher trainees on the issues in general rather than in a context of a specific lesson. The interview guide was emailed to the interviewees a few days in advance to give them time to prepare themselves for the interviews.

Computer assisted qualitative data analysis software TAMS Analyzer was used for thematic analysis of the transcripts. The unit of analysis was the whole response given to one of the four questions specified in the structured interview guide, easily recognizable from question–response pairs repeated across the data. The themes were developed within (but not across) the responses (*i.e.*, the units of analysis), which resulted in four distinct categories of themes. First, a list of potential themes was produced from the reading of the data and then initial descriptions of the themes were written. Then, each unit of data was compared with the descriptions and assigned a code. Constant comparisons progressively clarified and refined the descriptions of the themes.

It is important to note that the thematic development aspired to condense the teacher trainees' responses into the bare minimum to capture the essence of their conceptions, which resulted in highly abstract themes. It was therefore possible to keep the unit of coding short and apply the codes exclusively onto the data, avoiding the overlap of related themes in the data. This protocol was adopted to increase discrimination and rigour in the code development and assignment, but also to operationalize the object of analysis (*i.e.*, conception) aptly. It is also important to understand that ideas were thematized and compared and not individual teacher trainees, meaning that the same teacher trainee could express various (and possibly even contradictory) conceptions.

## 3.4 Credibility of the research design

The research design of the empirical studies was inspired by the ideas of Grounded Theory. The studies were data-driven. The data were collected without specific theoretical considerations and with little regard for particular models, except the very general level concepts of (task-based) information seeking and retrieval research. The data were also analysed by constant comparisons. The strength of the naturalistic inquiry (see Lincoln & Guba 1985) is that the tendency to project existing constructs on the data is reduced (see Boyatzis 1998: 13–14). The limitation is that the findings are not generalizable to other populations of teacher trainees. The transferability (Lincoln & Guba 1985: 296–298) of the findings to other contexts can be considered only within the limitations of knowing only about the (sending) context of the present studies[9] (*ibid.*: 316).

The data collection methods bear certain limitations. Individual interviews were chosen over group interviews, because teacher training as a whole is an individual effort. The teacher trainees had their own individual schedules for giving the practice lessons. Therefore, it would have been impractical to organize group interviews as soon as possible after the lessons were held. Group interviews can help interviewees activate their personal knowledge, but they can also help them construct it collectively as well. Many respondents were also unwilling to be

[9] Further discussion on the transferability of the findings is provided in Chapter 5.4.

interviewed or observed in their own homes or just preferred interviews on the premises of the training schools, which ruled out think-aloud interviews and direct observation of information behaviour in the midst of lesson planning activities. Conducting interviews retrospectively also ruled out collecting longitudinal data about lesson planning as a process in time. The teacher trainees were also writing journals (*i.e.*, blogs) to facilitate their reflective practice, but these did not contain any data on their information seeking and use or conceptions of information literacy instruction.

Studies II and III were conducted with the acknowledgement that collecting data on human behaviour by interviewing is subject to interviewees' biases, memory failure and retrospective interpretation and conceptualization. Study IV exploited the sources of this bias explicitly, as the idea of teacher trainees exploiting their experiences of information seeking and use for information literacy instruction is in fact premised on retrospective conceptualization. From this point of view, the teacher trainees' ability or inability to articulate their conceptions may in itself be meaningful and not the interviewer's failure to elicit pieces of relevant information.

To increase the credibility of the findings (Lincoln & Guba 1985: 294–296), the data sources were triangulated (*ibid.*: 305–307) by using two different data collection methods and multiple different types of data sources. The data sources include three different groups of teacher trainees majoring in various subjects, instructed by two different teacher educators, and the data were collected in two academic years, reducing the likelihood that the findings were down to particular unique circumstances.

A miscalculation in the interview guide was in expecting too much from the teacher trainees in terms of reflection. Many were unable to consistently differentiate between purposes for which they sought information (Appendix 2: question 4), meaning that the teacher trainees were also unable to relive their information seeking episodes relating to each purpose (Appendix 2: questions from 5a to 5g). Most of the teacher trainees were also unable to answer the question about what they learned from the information sources they had used (Appendix 2: question 5g). Learning specifics from information sources is contextual and that knowledge is the first to disappear from memory. These limitations were considered in Study III.

# 4. The key findings of Studies I-IV

## 4.1 A critical review of research on information behaviour in assigned learning tasks (Study I)

Study I reviewed research on students' information behaviour in assigned learning tasks. In the original literature review[10], learning assignments were approached as information intensive work tasks, and the literature was organized according to a task-based process model. The process model for students' information seeking and use in inquiry learning assignments elaborates Kuhlthau's (2004) ISP by explicitly discerning between the levels of the cognitive and the behavioural in the performance of the learning task. The key ideas captured in the model are that

- the teacher introduces intended learning outcomes as explicit learning goals and describes requirements for the output of the task
- the core learning process between students' learning goals and their learning outcomes is internal to them and observable by the teacher only externally through the documentation and communication processes
- the model explicitly suggests that the teacher should intervene in the students' learning processes based on information available about their progress in the task.

Students' responses to learning assignments are characterized by the external origin of these tasks: learning assignments are imposed on them and often concern topics they know very little about. Learning assignments are therefore from the outset called for being capable of motivating[11] students to the task. Prior knowledge

[10] The original findings have been reorganized for the present chapter to focus on the challenges associated with information literacy instruction with imposed learning assignments, and on the ways in which teachers are informed to design learning assignments and intervene in students' learning processes. Consequently, the selection of literature was narrowed down considerably from the original research paper.

[11] Different bodies of research literature identify motivation as a major influence on students' (initial) receptivity to learning assignments. In studies focusing on students' psychological characteristics the concept has been operationalized as the combination of a student's sense of control over, success and satisfaction in an activity and its importance to the student. Motivation can be extrinsic, imposed

is a basis for understanding, which enables students to generate their own research questions. In the school context, students tend to interpret learning assignments as reporting exercises and not as research tasks involving analysis, interpretation and critical thinking. This seems to be because the students define learning assignments in terms of the discursive practice of the school by which carrying out a correct procedure becomes a meaningful response to learning assignments. Particularly open, vague and extensive assignments, accompanied with (perceived) lack of time to pursue them, need narrowing and refining to encourage analysis, interpretation and critical thinking. (Alexandersson & Limberg 2003; Gordon 1999; Hultgren & Limberg 2003; Limberg 2007.)

Many students understand research assignments as reporting exercises and seek others' answers to the teacher's questions. They spend little or no time in formulating researchable questions, assessing information content or constructing systematic knowledge of acquired information. The lack of developed research questions seems to create difficulties for the students' information seeking and learning. Research assignments are thereby simply reduced into specific search terms for information seeking to find the "right" information sources – the ones that seem to concern the topic and offer enough information to be copied. The students choose a topic, find a few sources, compile and present facts in their reports regardless of the nature of the assignment. The consequences are uncritical acceptance of information, switching research topics according to information encountered and the use of few sources only. Their use of information is limited to copying and pasting from a small number of information sources or, at best, paraphrasing by closely preserving the structure of original documents. (Alexandersson & Limberg 2003; Hultgren & Limberg 2003.)

Kuhlthau's (2004: 40–51, 81–84) model of the information search process (ISP) was identified as a major contribution to conceptualizing students' learning process. The model predicts that vague thoughts and the feeling of anxiety involved in the exploration of a general topic persist until the student is able to direct information seeking to a particular aspect of the topic. Motivation increases and intellectual engagement to the topic intensifies after formulation of a focus. In the focus formulation stage the student concentrates on general information to choose a

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from the outside, or intrinsic, originating from the student's own curiosity. (Ford 2004; Heinström 2002: 112–113.)

guiding idea or a theme, which gives a direction to pursue, instead of seeking more information on a general topic. Many students keep seeking information for unfocused topics and move prematurely to complete their learning assignments, therefore remaining unmotivated throughout the process. Students' tendency towards seeking "right" answers is an impediment to focus formulation, because the right answer depends on what each student needs to know in a particular situation to advance his or her understanding of the topic. (Kuhlthau 2004: 40–51, 81–84, 94–96.)

The literature review identified studies scrutinizing variation in students' responses to learning assignments. Todd (2006) has elaborated students' ways of transforming and integrating topical information with their existing knowledge bases to create new personal knowledge. Their use of information through a learning assignment manifested as two distinctive patterns in the substance, amount and structure of statements expressed on the topic of the assignment. The predominant pattern was the additive approach wherein the students progressively gathered more facts. They expressed more descriptive topical statements with weakening integration between the statements at each task stage. At the end of the process, they organized the statements to some extent into thematic units. Fewer students adopted the integrative approach. Herein, the students developed explanations out of facts and synthesized more abstract and coherent groups of statements throughout the stages, reducing the number of statements. The endpoint representations of knowledge showed structural coherence between the expressed statements. (Todd 2006.)

Limberg (1999a; 2005) demonstrated that students' ways of seeking and using information for a learning assignment about a controversial issue closely relate to their learning outcomes. Two polar opposites of the approaches identified are discussed here. The fact-finding approach is about finding a specific answer to each research question. Physical and intellectual ease of access and direct answers to research questions are preferred. To avoid information overload, the number of sources used is limited mechanically so that it indicates that there is enough information when no time or energy is left. Surface criteria are used to assess the authority of sources, and expert opinions are preferred. Biased or contradictory sources are found difficult to use, or confusing, due to the lack of facts. The learning outcomes comprise only discrete bits about a topic within the limits of qualifying

sources. The opposing scrutinizing and analysing approach is about seeking a thorough understanding of a topic. Information that provides different perspectives on the topic is preferred. In order to reduce information overload, a structured view on the topic as well as redundancy are sought. Information is considered to be enough when the topic can be analysed comprehensively. Expert opinions are compared with those of others', and biased information is considered useful for analysing arguments from different perspectives. The outcomes from learning will show the development of knowing discrete facts at a deep and multifaceted understanding of the topic. (Limberg 1999a; 2005.)

Limberg (1999a; 2005) demonstrated that not only the character of the learning assignment but also (students' relationship with) the subject matter of the assignment influences students' ways of information seeking and use and, ultimately, their learning outcomes. The learning assignment with the goal for understanding and analysing a controversial issue emphasized particularly the variation in students' conceptions of relevance, enough information and bias. Some students' insufficient prior knowledge about their topic, an uncontroversial topic or skewed overload of information from one perspective was associated with particular ways of information seeking and use. There seems to be an interactive relationship wherein (a) students' approaches to information seeking and use influence their understanding of the subject matter and, ultimately, their learning outcomes, and (b) students' understanding of the subject matter influences their ways of seeking and using information. (Limberg 1999a; 2005.)

Students' interaction with acquired information sources and their self-produced documents have received limited attention in information seeking and retrieval research. McGregor and Streitenberger (2004) showed that students' orientation either towards the end product or the learning process shapes their ways of using information. The students, who demonstrated little or no awareness of seeking meaning, making sense or learning, orientated towards the end products of their learning tasks. They showed a strong desire to make the required product look "right" in the ways they had envisioned based on their prior experience and the instructions for the assignment. They did both legitimate (*i.e.*, citing) and inappropriate copying (*i.e.*, plagiarizing) from the original information sources rather than paraphrasing texts or synthesizing ideas. The minority of students, who demonstrated involvement in the processes of seeking meaning, making sense or

learning, tended to summarize, paraphrase and synthesize. They also remained motivated to the task. (McGregor & Streitenberger 2004; McGregor & Williamson 2005.)

The literature offered little concerning students' use of information in producing the end products of their tasks, the characteristics thereof or how the learning products relate to their learning outcomes. The steps of the process of developing a mixed bag of notes based on search results and acquired documents into a more or less coherent paper, had not been investigated. Kuhlthau (2004: 47, 80) does mention briefly about students' note-taking or underlining, marking systems for organizing information and outlining ideas to organize for writing, linking these functions with the stages of the learning process and being either supporting or hindering to the learning process. The research has relied mostly on interviews and surveys or settled for students' self-assessments or teachers' assessments of students' papers rather than the primary documents produced by students (see Kuhlthau 2004: 56; Limberg 2005; Todd 2006). Kuhlthau (2004: 57–58) found that the number of sources used and teachers' assessment of focus in students' papers did not correlate, but the increase in the students' confidence and the teachers' assessment of focus in their papers, in fact, did.

While characteristics of learning assignments have not been systematically studied in information seeking and retrieval research, the literature gives some ideas on the ways teachers could design learning assignments. The teacher should make sure that students have realistic means to carry out learning assignments and that relevant information resources are available (Hultgren & Limberg 2003). More specifically, enough time should be reserved so students can develop interest in their topics (Kuhlthau 2004: 86). The assignments should discourage plagiarism by guiding students into contact with several information sources with differing viewpoints to encourage critical thought and analysis (Hultgren & Limberg 2003). Learning assignments should also be adapted to students' cognitive development and prior knowledge to give them enough familiar context for integrating new knowledge, while avoiding too much redundancy (Kuhlthau 2004: 96–97, 101, 113). The assignments should invite students to adopt personal viewpoints worth investigating by raising questions and problems (Hultgren & Limberg 2003; Kuhlthau 2004: 81).

Information seeking and retrieval research has also made recommendations for teachers on how to intervene into students' learning processes. Students' intellectual engagement with information intensifies with the formulation of a focus on a particular aspect of a topic. The teacher could raise awareness of the sequence of thoughts, feelings, and actions commonly experienced in the learning process, provide situations that promote the formulation of a focus and offer opportunities to experience increased interest during the task performance by reserving enough time. The teacher could encourage, reassure, advise and exhort especially those students who are unmotivated. Curiosity might be fostered with well-timed hints and clues helping to solve the problems. The teacher could also take the role of a student, participate in and contribute to the other students' knowledge construction and encourage open negotiation about what is meaningful. Condemnation of plagiarism alone, on the other hand, does not seem to eliminate the behaviour but only encourages students to do their best to hide the most blatant examples. (Alexandersson & Limberg, 2003; Kuhlthau 2004: 86; Limberg 2005; McGregor & Streitenberger 2004.)

Study I clarified the research area of information seeking and learning. Learning tasks were elaborated as a distinct research dimension to students' psychological characteristics and contextual characteristics. Learning assignments were seen as instructional tools encompassing information literacy as a sub-goal of subject teaching. The task-based approach proved a promising avenue to synthesize research on information seeking in learning assignments and learner-centred instructional methods. Information seeking and retrieval researchers are aware of the pedagogic challenges involved in designing learning assignments for inquiry learning in schools and suggest general design principles. The information seeking and retrieval research identified for the components of the process model was inconclusive, though, particularly concerning the documentation and the communication processes and the end products of learning assignments.

## 4.2 Prospective history teachers' information behaviour in lesson planning (Study II)

Study II piloted and introduced research ideas concerning teacher trainees' information seeking and use in lesson planning. The study was motivated by the notion of the new generation of teacher trainees and the ways in which they might be using (or not using) the Internet for their own purposes. The pilot emphasized the lack of research on teacher trainees' information seeking and use conducted particularly in the authentic context of real (work) tasks. Therefore, an overview of teacher trainees' information behaviour in the context of lesson planning was sought.

The findings show that the teacher trainees accessed various types of information sources through various channels. The Web was used in conjunction with the more traditional teachers' information seeking channels such as libraries, colleagues and personal collections. The teacher trainees' means of accessing information were diverse: directly from the browser's address field, through a search service (typically Google) or a directory service. The teacher trainees brought up their concern for the authority of information sources particularly on the Web and suggested cross checking multiple information sources as a way of ensuring trustworthiness. Their other criteria for assessing information sources were particularly illuminating for lesson planning as a task. The way the teacher trainees considered topicality as a selection criterion framed by the curriculum, preceding and following lessons suggested that they were thinking in the long term in lesson planning. The teacher trainees also considered their students' comprehension in designing learning assignments to the students' cognitive development and prior knowledge. To do so, they selected information sources on the basis of their estimation of the work needed to adapt the information content for use in the classroom.

The most general aspect of the teacher trainees' information seeking patterns was concerned with the specificity of their search goals so that when facing the topical breadth of history and social sciences curricula, they expressed themselves to being at varying degrees familiar with the subject content areas of the lessons. Consequently, this led to a substantial variety in the specificity in their search goals. Their patterns of information seeking behaviour varied from returning to information sources on the basis of past experiences to exploring broad topics while

still learning about them. The more specific patterns of accessing information resources were concerned with the choices of information channels and sources in seeking information. The teacher trainees accessed the Web and trusted it, if the various information sources there were in agreement, but otherwise the university library was accessed as a more authoritative second order choice. Textbooks were often accessed first to frame and learn about the topic, because exploring general topics on the Web without clarified goals often became laden with information overload.

The teacher trainees used information for two general purposes in lesson planning. First, they framed or refined a topic and learned about it or rehearsed one for themselves. This could be done, for example, by writing down lists of essential themes in the textbook, comparing different series of authorized textbooks, and modifying the list to reflect themes recurrently occurring in the literature. Second, the teacher trainees prepared to communicate ideas to students. They designed ways to present information content to the class (*e.g.*, lecturing or displaying pictures to illustrate and exemplify topical ideas), various learning activities (*e.g.*, exercises) or didactic devices (*e.g.*, displaying pictures to motivate the students, maintain their interest or initiate discussion). This was done with the students in mind: information was seldom directly transported from information sources to present in the classroom. The teacher trainees gave many examples of how information was transformed to make it serve their didactic purposes: documents were selected and shown only in part, vocabulary was simplified and reduced, and information from several sources was synthesized.

The teacher trainees' descriptions of their personal learning outcomes of lesson planning included various mechanisms for managing the process and coping with information overload: selecting information channels and sources purposefully, narrowing down topics early before extensive information seeking, filtering information and learning to determine when sufficient information is acquired. Finding purposeful ways to present information to students was another significant area of learning. One teacher trainee spontaneously brought up being aware of his own information seeking practices as something to take a note of in teaching information seeking.

Study II provided an overall picture of the prospective history teachers' information behaviour in lesson planning. It suggested research topics to address in

further studies: the full scope of teacher trainees' information seeking channels and the variation in their search goals. The study also introduced the idea of teacher trainees' reflecting on their own information seeking and use to develop their conceptions of information literacy instruction.

## 4.3 Teacher trainees' information acquisition in lesson planning (Study III)

Study III readdressed and elaborated on some of the issues identified previously in Study II, specifically the teacher trainees' use of information seeking channels and sources and the ways in which they acquire information in lesson planning. The task was refined as a framework of the analysis. As a premise, the study focused on the teacher trainees' information acquisition for a single lesson plan from each teacher trainee.

The study discerned systematically between information channels and sources to provide an authentic picture of where information sources were accessed in the course of the task and which sources actually contributed to the task. Referential knowledge about information sources used in information seeking was distinguished from the information sources contributing directly to the task proper. Websites, online library catalogues, reading lists and any mediators making recommendations for information sources available from somewhere else, were not considered as information channels or sources in the study. The study elaborated on a repertoire of six information channels used by the teacher trainees to acquire information in lesson planning, organized here by the number of teacher trainees using them.

Personal collection (n=21/23[12]) was identified as an information channel, which comprises those sources wielded by the teacher trainees when engaging in the task. The core characteristic of the information channel is unconditional access to these sources: a familiar book in the library or a Website might become inaccessible for reasons beyond the teacher trainee's influence. The teacher trainees retained in their personal collections information sources acquired in the past through external information channels, which included textbooks, non-fiction in general, periodicals

[12] See Table 3-3.

(*e.g.*, newspapers and magazines) and educational materials (*e.g.*, teacher's guides and other instructional materials). The teacher trainees' personal collections comprised also information sources that were of personal origin: their lecture notes, photographs and even their children's school work. They also produced personalized files by cutting or saving pieces of information such as newspaper articles and PowerPoint presentations from various published information sources into binders or folders on their personal computers. In so doing, they could and would forget about the origins, making these pieces of information on media into sources as such.

Web (n=21) was identified as an information channel that provided access to information sources available in the World Wide Web. It is not concerned with full-text or reference databases available through the Web, because the content of such databases are not generally accessible or the information sources immediately available over the Web. While a half of the teacher trainees named the Websites accessed, the others alluded to the Web as a whole or to the tools used for searching information from the Web, leaving individual information sources on the Web unspecified and unnamed. Particularly, the most commonly mentioned source of images on the Web was the search engine Google.

Interpersonal resources (n=10) comprise the teacher trainees' mediate or immediate, synchronous or asynchronous contacts with people as an information channel. The people constituting interpersonal resources (*i.e.*, the information channel) provided access to information sources, but also became (informal) information sources in themselves when they provided information directly. The teacher trainees pointed out their mentor teachers and various other people such as university teachers, colleagues, co-workers from previous workplaces and even their spouses as information sources. These people also often had the role of an intermediary by referring to information sources available through other information channels than themselves, but they were not considered as the information channel in that case.

Libraries (n=10) encompass school, public and university libraries by physical visit on the spot. The online library catalogues available through Web interfaces were the only type of database accessed by the teacher trainees. Again, checking up online catalogues for references caught from the Web or hints received about relevant items did not establish access to the items in the library, as useful as such

referential information might have been to the teacher trainees. The teacher trainees still had to physically visit the libraries to get the items.

Observation (n=6) constituted an information channel, where the teacher trainees attended fellow teacher trainees' lessons to observe their didactic practices and students' behaviour. The information channel provided access to contextual information unavailable from documentary information sources. However, the lessons encompassing the teachers and the students in teaching and learning were sensory data to the teacher trainees and therefore not information sources in the sense of the interpersonal resources.[13]

Visits to exhibitions (n=2), public displays such as fairs and museum centres, offered the teacher trainees (printed) supplementary materials free of charge. To be considered as a type of information channel in the analysis, exhibitions required a visit in person whilst the lesson was planned.

Both observation and visits did not seem to be purposively carried out for individual lesson plans, although the information acquired thereof influenced the on-going lesson planning processes. Particularly, visits are an incidental information channel for teacher trainees in lesson planning, as their use is typically dependent on the timing of field trips or their own leisure time interests. The materials gathered from visits are rather stored in the personal collections for future use, therefore obscuring the origins of such materials. The reservation made in the original research paper was concerned with the fact that the teacher trainees did not explicitly cite interpersonal resources, observations or visits as information channels, which their responses across the data nevertheless indicated. It is reasonable to assume that most teacher trainees observe others' training classes at least if they are assigned to teach the same class later on. The findings of the study may not, thus, entirely represent the conceptions the teacher trainees actually have regarding their information behaviour.

The term information acquisition was adopted over information seeking to capture the continuum from accidentalness or serendipity to goal-orientation or -direction in information acquisition. The term mode was used of the way or the manner in which information was acquired. The modes were distinguished of

[13] Ingwersen and Järvelin (2005: 52) argue that an observer is both a generator and a recipient of information by self-imposed intentionality on sensory data. Therefore, the observer is an information source to him- or herself.

(conscious) information seeking strategies, which imply a purposeful activity, and patterns, which by definition involve consecutive steps of action. The modes of information acquisition were presented as a continuum beginning with the most goal-oriented and ending up with the most serendipitous mode. The teacher trainees' modes of information acquisition in the descending goal-orientation were the following: Seeking known-items (n=18), Seeking with direction (n=10), Surveying the topic (n=18), Monitoring (n=5), Accidental encounters (n=3) and Being given information (n=5).

Seeking known-items occurred when the teacher trainees returned to familiar information sources at known locations for information content or items they were familiar with. Seeking with direction occurred when the teacher trainees had clear ideas of what they were seeking but could not access relevant information sources or items in information sources by recall. Surveying the topic occurred when the teacher trainees conducted sweeping searches without expressing direction towards specific goals or pieces of information. Monitoring occurred (or had occurred) when the teacher trainees kept watch (or had kept watch) on certain information sources or places for information to use in their present (or a future) lesson plan. Accidental encounters occurred when the teacher trainees serendipitously found information sources in situations where they were not seeking contact with information sources, or valuable information in information sources already in their possession. Being given information occurred when the teacher trainees, without actively asking for help, were informed by sources or directed to sources by mediators working on their behalf.

Study III demonstrated that the teacher trainees' information acquisition extended beyond present lesson plans in ways that could not be captured in goal-orientated conceptions of information seeking. Their modes of information acquisition reflected a core characteristic of lesson planning: the task was being reiterated over the training period, meaning that the teacher trainees could capitalize on their earlier efforts when acquiring information for the present lesson plans, and think in the long term by predicting similar future tasks. The teacher trainees actively sought information for their present lesson plans from external information sources. However, the entirety of their information acquisition encompassed information sources acquired in the past and stored in their personal collections and modes of information acquisition at the passive end of the continuum: monitoring, accidental

encounters and even being given information by someone else. The paper concluded that continuity across tasks is an important characteristic of lesson planning and that time is a central dimension to consider in teacher trainees' information acquisition.

## 4.4 Teacher trainees of the Internet Age: changing conceptions of information literacy instruction? (Study IV)

Study IV was motivated by the notion that the very basic practices of schooling have been challenged by fundamental changes in the information and media environment to which teachers have not been fully able to respond. It was suggested that practising teachers' difficulties in developing approaches and practices for the new information and media environment could be explained by their lack of authentic experiences of using the new information and communication technologies for their own purposes. It was then argued that teacher trainees are (very likely) to be more experienced in using the new information and communication technologies for their own purposes, and therefore (arguably) able to exploit their experiences to suggest up-to-date didactic ideas utilizing the new technologies. The argument obviously presumed significant differences in the ways teacher trainees and practising teachers understand the use of the Web in information literacy instruction.

The argument was transformed into a broader research task, which scrutinized contemporary teacher trainees' experiences of information seeking and use and their conceptions of teaching information seeking and use, specifically addressing the teacher trainees'

1) experiences of challenges in seeking and using information (in lesson planning)
2) conceptions of the transferability of their experiences for teaching information seeking and use
3) perceptions of challenges in teaching information seeking and use

4) practical ideas for learning exercises[14] exploiting the Web (in information literacy instruction).

Auxiliary concepts were introduced to discuss two orders of information literacy. The lower-order is concerned with recall of relevant knowledge, (basic) reading comprehension and applying procedures in a (specific) situation (Reece 2007). Examples of such lower-order skills include reading to locate a relevant part in a document (Williams & Wavell 2007), mimicking a demonstration on how to access information sources from the Web (Reece 2007) or how to navigate between types of information sources in a particular order (Limberg & Folkesson 2006). The higher-order captures various critical thinking skills involved in analysis, synthesis and evaluation of information content – determining how parts relate to one another and the whole, reasoning from general to specific and vice versa, and determining value, making decisions and comparing ideas, respectively (Reece 2007). The higher-order information literacy is in many ways about making sense of information from many different sources in relation to previous knowledge (Williams & Wavell 2007).

The teacher trainees' challenges relating to the lower-order skills of information seeking comprised the choice of the (right) information channel and the (practical) difficulties in accessing information sources. The challenge in the assessment of information sources involved using the lower-order skills to find sources with the desired general qualities, such as accuracy and trustworthiness. The challenges relating to the higher-order skills of information seeking comprised discerning the essential in subject content to meet students' needs, finding information that would suit students' comprehension, choosing between differing textbooks and settling on what is enough[15] information for a single lesson. The challenges in information use involved using the higher-order skills to process presentable "pedagogic content" from acquired information sources and translating[16] from a foreign (*i.e.*, English) language.

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[14] The exact form of the learning assignment was not specified to the teacher trainees, who were thereby given a great deal of freedom to express their ideas about learning assignments in their responses.

[15] See Chapter 4.2 for the teacher trainees' personal learning outcomes of planning lessons.

[16] Strictly speaking reading comprehension is a lower-order information literacy skill, but considering that the teacher trainees were translating to teach students of much younger age than themselves, characterizing it as higher-order information literacy is justified.

The experiences that the teacher trainees found transferable to teaching were mostly of the lower-order of information literacy. The experiences concerning information seeking captured procedures about searching for information (on the Web), knowing (sources) where to find relevant information, and using various information channels and not just the Web or the conventional media. The experiences concerning the assessment of information sources were of the lower-order as well: procedures about assessing trustworthiness and authorship of information sources (on the Web) or knowing about trustworthy information sources and being "critical" (or in some ways wary) of information sources on the Web. Some teacher trainees explicitly denied finding any of their experiences transferable. Only a few teacher trainees brought up the issues of discerning the essential and comparing different information sources to verify pieces of information from the higher-order of information literacy. It is worth noting that the teacher trainees did not consider their experiences of settling on what is enough or presenting information content as transferable.

The teacher trainees' perceptions of challenges in teaching information seeking and use mostly concerned giving procedural instruction in using the lower-order skills. The perceived challenge in information seeking was to instruct students, who preferred modern technologies, in library use. The challenges relating to the assessment of information sources were about teaching how to be "critical", selective or discerning in assessing information sources, wherein the criteria suggested for assessment were (generic) accuracy and trustworthiness. Many teacher trainees' perceived their own lack of skills to use the information and communication technologies, to search information on the Web and to use databases as a challenge. A few teacher trainees found their students' lack of skills in using the Web to search for information a challenge. A few found the lack of time to teach information seeking and use in subject teaching as problematic. Some teacher trainees perceived that to motivate students to seek information by themselves was difficult. Not many teacher trainees described challenges in instructing higher-order information literacy. These teacher trainees mentioned that they felt challenged in getting students to understand the subject content, meaning to demonstrate that historical knowledge is inexact by nature (unlike the natural sciences), irreducible to only one right answer, and (that consequently) students should (learn to) discern

what is essential. Preventing plagiarism was another challenge in achieving higher-order information literacy learning outcomes.

The teacher trainees' ideas for information literacy instruction varied considerably between the goals of the lower-order of doing procedures and the higher-order of (genuine) critical thinking. A generic lower-order goal was to get students to understand that some information sources on the Web are more accurate and trustworthy than others. Another was to get students to use more than a single (type of) information source. A few teacher trainees' ideas also comprised the higher-order goal of getting students to process information in ways that, at best, demonstrate understanding of the interpretative nature of (historical) knowledge (as opposed to just knowing facts). It is vital to notice how these ideas fall short of being practical solutions for perceived problems, because they express only the learning goals of the exercises but not any means of how to achieve them.

The teacher trainees gave few indications of thinking towards practical solutions for problems perceived in students' information behaviour. Many of them regarded descriptions of learning assignments as a means to orient students' information behaviour at the various learning goals. The practical ideas involved setting proper scope for the task, introducing assignments carefully, giving written and oral instructions, phrasing questions appropriately, and balancing between open and closed ended assignments. One suggested open questions to encourage students to go beyond seeking facts, and another for strict worksheets with procedures to follow and right points to find. A few teacher trainees planned to introduce students in advance to the information channels and sources available to them and recommend good sites to start. Some teacher trainees suggested guidance by active interventions into students' information seeking processes: planning queries and assessing information sources together. One idea proposed was the higher-order thinking skills as the focus of instruction: assigning students to compare content of different information sources.

Some teacher trainees' ideas for learning assignments demonstrated their awareness of practical problems associated with the use of the Internet in information literacy instruction. These teacher trainees' ideas focused on the teacher's rather than the students' needs, however. A few teacher trainees proposed keeping students occupied with the task to hold the class under their control, where a few others suggested restricting students' access to preselected Websites only. Yet

again, a few teacher trainees wanted to ensure in advance that relevant resources are available and accessible from the Web.

Study IV demonstrated that the teacher trainees' conceptions of information literacy instruction were like practicing teachers'. The findings suggested that the teacher trainees' would not use the Web as a new potential in information literacy instruction. The issues teachers have in information literacy instruction are not because of their lack of personal experiences in using the new information and communication technologies.

## 4.5 Synthesis of the findings

The characteristics of learning assignments influence students' information behaviour, emphasizing the importance of designing learning assignments purposefully. Sub-optimal designs can bring about inquiry learning and meaningful information literacy learning outcomes but only for a minority of students. The design of learning assignments should also consider the interaction between students' understandings of the subject matter and their approaches to information seeking and use.

Overall, the teacher trainees' information seeking channels and sources and their modes of information acquisition were diverse. Trust and convenience were among their criteria for choosing information channels. The Web constituted a significant form in the teacher trainees' access to information, but it was used selectively, in conjunction with the conventional teachers' information channels. The factors influencing content selection were (long-term) topicality, authority (and trustworthiness) and the amount of time needed to adapt information. The teacher trainees acquired information in modes, where their search goals varied from seeking specific pieces of information to accidental encounters with relevant information. Seeking known-items from personal collections and exploratory information seeking were commonplace in lesson planning. Exploratory information seeking on the Web, particularly, was associated with issues in managing the information seeking process.

The teacher trainees were aware of many aspects of information acquisition and use that could be exploited in information literacy instruction: using the various

modes of acquiring information, selecting between different information seeking channels, assessing information sources (by other criteria than authority), discerning the essential information in sources, managing the information seeking process and using (applying and reproducing) information. The teacher trainees did not find their experiences of using these higher-order skills transferable to information literacy instruction. Most teacher trainees were thinking about demonstrating procedures in using the lower-order information literacy skills. Few teacher trainees, though, mentioned embedding subject content into information literacy instruction, but they were not able to suggest practical solutions for developing students' higher-order information literacy along with subject content.

# 5. Discussion

## 5.1 Designing information literacy learning assignments

The first research question was: *"What are the key issues in designing information literacy learning assignments to encourage students to engage in inquiry learning in schools?"* The earlier research findings suggest that learning assignments must be carefully designed towards achieving (specific) information literacy learning outcomes. The findings also suggest that a fundamental issue in school-based information literacy instruction is students' understanding of learning assignments. Students' understanding of the learning goals laid down in the assignments and the learning outcomes may or may not resemble those intended by the teacher. As students can understand learning assignments in various ways, the teacher must ensure that they are understood appropriately. Students' motivation seems to be something that emerges from the contact of their personal viewpoints and the design of the learning assignment rather than something that teachers could decidedly bring about.

Research informing the design of information literacy learning assignments is scarce. The teacher trainees' content selection principles, as identified in Study II, illustrate their awareness of the cognitive development and prior knowledge of their students, meaning that they need more specific design ideas for information literacy instruction than reiterations of these two. Limberg *et al.* (2008) emphasize designing learning assignments for meaningful learning outcomes. Teachers may find it self-evident to specify explicit learning goals, as this fundamental aspect of lesson planning is carefully addressed in teacher training (see *e.g.*, John 2006). The point is, however, that the information literacy learning goals concerning, for example, (situational) assessment of relevance, the concept of enough, critical assessment of information sources, and information use (Kuhlthau *et al.* 2007: 77–91, 111; Limberg *et al.* 2008; Limberg & Alexandersson 2010) support the learning goals set for knowledge content of the assignment. As students' responses to learning

assignments are subject to (their understanding of) the information content (Limberg 1999b; 2005), teachers should consider their information literacy instruction goals on one hand and the intended knowledge content on the other.[17]

Information literacy instruction needs to address, in addition to the proper design of learning assignments, interventions into students' learning processes, so that the learning goals of the assignments are achieved. The design considerations are particularly important because teachers' resources for intervening in individual students' learning processes in the classroom phase of teaching are limited. Adopting the inquiry process as the premise of interventions in information literacy instruction is a proven approach (Kuhlthau 2004: 124–126, 146–147). Teachers may also want to introduce the learning assignment to students beforehand as a process proceeding over the series of stages along with the sequences of the subtasks, thoughts, actions and feelings commonly involved (Kuhlthau 2004: 86). The teacher should consider the following advice in guiding an inquiry process.

- The teacher and students should negotiate common learning goals considering the teacher's intentions for learning outcomes and the students' personal interests (Limberg *et al.* 2008).
- The teacher should actively interact with the students throughout the task process to help them to frame research questions that transform a broad topic into a researchable problem so that the students do not seek ready-made answers for fact-finding questions (Hepworth & Walton 2009: 78, 84; Hultgren & Limberg 2003; Kuhlthau 2004: 81, 146–147, 197; Limberg *et al.* 2008; Limberg & Alexandersson 2010).
- The teacher should guide the students' critical analysis of information sources by challenging their understanding of information content and offering meaningful feedback based on their research questions throughout the learning assignment (Kuhlthau 2004: 118–120; Limberg *et al.* 2008; Limberg & Alexandersson 2010).

A recent empirical study by Hongisto and Sormunen (2010) elaborates on interactions in the classroom between a teacher and students during a learning

[17] If a student chooses or is assigned a topic with information content that is not in line with the information literacy learning goals of the assignment, the student is from the offset given very little to work from compared to those students with topics with more suitable information sources available.

assignment. A major finding was that while only a minority of the students' expressions for help were about the subject content of the assignment, the majority were concerned with the use of technical tools and task management. The learning assignment lacked explicit research questions and the various information skills taught were introduced independent of the subject content. (Hongisto & Sormunen 2010.) These findings corroborate the earlier work concerning how teaching information skills in isolation of subject content encourages students to adopt learning various skills and procedures as their primary learning goals instead of knowledge content.

Recent research has also touched on the end products of students' tasks as outlined in the process model[18]. Sormunen and Lehtiö (2011) present writing in the genre of a Wikipedia article as an authentic and meaningful platform for information literacy instruction that has potential to motivate students. However, thoughtless copying and pasting is an obstacle for students' achieving meaningful information literacy learning outcomes with source-based writing assignments. It is argued that high levels of copying and pasting are associated with a low interest in a genuine inquiry process on a topic and a strong orientation in finishing the end product instead. The empirical findings show that all groups in their study copied and pasted but also summarized and synthesized from information sources to their articles. The authors acknowledge that processing information in itself does not prove that the students were oriented towards the process. A much more revealing finding was that the sources plagiarized were the ones that were most easily adaptable for a Wikipedia article, for example other Wikipedia articles. Scholarly publications available in considerable numbers on the Web were not used at all, apparently for being too difficult to use. The authors also acknowledge that source-based writing assignments cannot support genuine inquiry learning, because Wikipedia does not allow personal analysis or original research. The findings however raise relevant questions about the quality of copying and pasting on the one hand and synthesis on the other, particularly if contrasted with the teacher's intended learning outcomes. (Sormunen & Lehtiö 2011.)

As a conclusion, information seeking and retrieval research has suggested ideas that would be applicable in information literacy instruction in schools. However,

[18] See above for Chapter 4.1.

few teachers apply these ideas in practice (Limberg *et al*. 2008). How teacher trainees can identify these ideas and suggestions for information literacy instruction on the basis of their own information seeking and use experiences is a topic for further discussion.

## 5.2 Teacher trainees' information behaviour in lesson planning

The second research question was: *"How do teacher trainees acquire and use information in lesson planning?"* Due to the lack of research findings specifically addressing teacher trainees, the findings of Studies II and III are compared to research on practising teachers' information acquisition and use in lesson planning, conducted since the emergence of the Web. In general, Studies II and III relate to, corroborate and elaborate on the following common findings:

- Teachers often seek information in lesson planning in exploratory patterns in which their goals, strategies, and relevance criteria evolve as they move between various information sources, often in a particular order (Bitso 2012: 136–137, 189–192; Lawley 2011: 26–29, 314–315; Small *et al.* 1998).
- The Web has for a long time complemented teachers' conventional information channels (Small *et al.* 1998), such as libraries, interpersonal resources and personal collections (Bitso 2012: 199–200, 208–209; Summers *et al.* 1983), but sources specifically designed to support teachers, such as digital libraries and electronic discussion lists, are under or even not utilized by teachers (Perrault 2007).
- Teachers seek information in lesson planning for a variety of purposes including seeking clarification of the requirements of the topic, background information and ideas about the topic, factual or specific information, extracurricular or supplementary content to engage the students' in the subject matter, and information sources to recommend to students (Merchant & Hepworth 2002; Perrault 2007; Lawley 2011: 121–122, 154–156, 206–208).

- Teachers do not have a great deal of time to spend in acquiring information, so they have to work on ways to efficiently and effectively use the resources available to them (Perrault 2007).
- Teachers are overwhelmed by the quantity of information resources available on the Web, find searching information from the Web time consuming and think that they lack skills to use the resources efficiently (Perrault 2007; Small *et al.* 1998).

Studies II and III demonstrated that the Web constitutes a significant form in the teacher trainees' patterns of accessing information resources in lesson planning.[19] The Web was approached with caution, and multiple information sources were crosschecked to ensure reliability. Study II described how the teacher trainees moved between different types of information seeking channels and sources. They started from familiar information sources already at hand before turning to other information channels, and switched from the Web to (less accessible) university library if the information sources found were not consistent and students' class level called for greater scrutiny. The teacher trainees, in other words, balanced the effort put on information seeking against the students' intellectual capabilities. To avoid information overload, they considered carefully the sense of using the Web and made purposeful choices of when enough information seeking had been attained. Study II, therefore, pointed out how the teacher trainees, by weighing the resources (mainly time and the quality of information sources) and the requirements (mainly students class level), sought satisfying rather than optimal results, much like what Lawley (2011: 308) observed.

Study II demonstrated that the teacher trainees, working with the topical breadth of history and social sciences curricula, expressed wide variation in their familiarity with the subject content areas of the lessons and, consequently, a substantial variety in the specificity of their search goals. Teachers may learn about the topics of their lessons, but their initial knowledge constitutes a topical frame of reference for information seeking (Lawley 2011: 154–156, 190–200, 206–208; 228–235). They may seek information to develop ideas about lessons (Perrault 2007). Openness to

[19] While the main focus of the present thesis is on teacher trainees' use of the new information and communication technologies, it is useful to consider if and when the more conventional teachers' information channels were preferred over the new ones. The teacher trainees were not required to use the Web, but as Studies II and III demonstrated, it was used extensively.

learn more about the topic may lead to accidental encounters and substantial changes in the learning goals and focus of the emerging lessons (Lawley 2011: 206–208, 314–316). Study III identified the variety of ways the teacher trainees' acquired information varying from the goal-directed and purposeful to the accidental and serendipitous, showing how, depending on the topic, the teacher trainees' information seeking in lesson planning could be both very purposeful for clearly defined goals, but also how it could also be exploratory and an integral part of the planning process itself, as the teacher trainees ideas for the lesson might have developed only through information seeking. This contrasts with the more experienced teachers with organized collections of lesson plans refined over time, which allows them to fill in and improve already existing lesson plans (Lawley 2011: 285). Creating a new lesson from scratch obviously evokes very different modes of information acquisition than incorporating information into existing plans.

Studies II and III demonstrated how the teacher trainees' short- and long-term thinking beyond the present lesson plan captured a temporal context, which spanned the present, preceding and following lessons. Teachers may plan as much as a year ahead, but daily lesson planning is where they concretize their general ideas (Jones & Smith 1997). Even the strictly task-based approach of Studies II and III illustrated how the teacher trainees' information acquisition and use in the context of individual lessons plans overlapped with other tasks in the broader context of the profession, thereby exemplifying one type of task emerging from teacher's work roles (see Leckie, Pettigrew & Sylvain 1996). The temporal context shaped the teacher trainees' modes of information acquisition, information channels and sources, and their perception of topical relevance. The temporal context fostered serendipity making accidental encounters possible in the first place. The teacher trainees sought information for and accessed their personal collections of information sources in lesson planning. Their monitoring of information channels and sources stretched over the time window of the present lesson plan. Information channels such as visits were used in maintaining personal collections for long term planning. The teacher trainees were familiar with what their students were taught and were therefore able to recognize topicality in broader terms than the lesson plan they were presently occupied with (see Lawley 2011: 250–251).

Teachers are atypical information seekers in the sense that they are not primarily seeking information for themselves but to present it to others to help them achieve

pre-defined learning goals. Their main challenge is to find material that presents subject content to students in a way that is engaging and pedagogically sound. (Lawley 2011: 274–275.) It has been shown that when selecting information content for lesson plans, teachers consider carefully what is appropriate to their students' intellectual and emotional capabilities (Bitso 2012: 258; Lawley 2011: 137, 155, 165–167, 266, 307; Merchant & Hepworth 2002). Study II described how the teacher trainees assessed and selected information sources already during information seeking by the amount of work needed to adapt the information content to the pedagogic purpose of teaching students of various ages and abilities. The teacher trainees did not use information content "as is" but transformed it to serve their pedagogic purposes. The teacher trainees were therefore not only applying information in the various planning activities of their own but also reproducing information to represent it (see Kari 2010).

It should be considered in interpreting the findings that some teacher trainees' were still at the end of their teaching practice period learning about information seeking in lesson planning. In Study II, the teacher trainees reported personal learning outcomes relating to filtering and selecting information sources and choosing channels purposefully, narrowing down topics early on and learning to determine when enough (information seeking) is reached. In Study IV, the teacher trainees reported as a challenge discerning the essential in subject content, finding information that would suit the students' comprehension, choosing between differing textbooks and settling on what is enough information for a single lesson. The teacher trainees identified in Study IV their lack of skills particularly in using the Web and databases to search information as a challenge in information literacy instruction. Information seeking in lesson planning clearly is not a trivial task for teacher trainees. It becomes a topic for another discussion on how the teacher trainees reflect on these experiences for information literacy instruction.

## 5.3 Teacher trainees' conceptions of information literacy instruction

The third research question was: *"How do teacher trainees exploit their own experiences of information seeking and use in their conceptions of information*

*literacy instruction?"* The discussion on the teacher trainees' conceptions of information literacy instruction is based on the division between the lower and the higher orders of information literacy presented in Study IV[20]. At the heart of the matter is that the teacher trainees described information literacy instruction in general, offering few examples of teaching subject content. It is, however, impractical to teach the higher-order information literacy skills without addressing subject content. To demonstrate the aspects of higher-order information literacy, the teacher trainees will eventually have to find ways to incorporate curricular content into their information literacy instruction.

The findings of the three studies show that the teacher trainees used the higher-order information literacy skills for their own purposes. The question is whether the teacher trainees perceived any of their experiences transferable to information literacy instruction.[21] A few teacher trainees identified their higher-order information literacy skills of discerning the essential and comparing information sources as (potentially) useful in information literacy instruction. The teacher trainees' perceptions of the transferability of the experiences were mostly, however, biased towards the lower-order procedures of choosing and accessing various information channels, searching information (on the Web) and assessing the trustworthiness of information sources. Overall, the teacher trainees found their experiences of using the higher-order information literacy skills less transferrable than their own use of these critical thinking skills would suggest.

Another question is if the teacher trainees identified relevant challenges in information literacy instruction. Some teacher trainees recognized students' difficulties in attaining the higher-order information literacy learning goals of understanding subject content and avoiding plagiarism. However, most teacher trainees identified as challenges teaching the lower-order skills of assessing the trustworthiness of information sources and giving instruction for using various information seeking channels. Many teacher trainees also identified their own lack of skills to seek information through the new information and communication

[20] See above for Chapter 4.4.
[21] Study IV did not address the teacher trainees' practices but their conceptions of information literacy instruction, meaning the outcomes of their reflections on information acquisition and use, which they found having some didactic use. While the point here is not what conceptions had been transferred but which the teacher trainees explicitly found transferable; contrasting the thematic findings suggest that such transfer occurred.

technologies as a challenge, as if they felt lacking in these skills particularly in the context of information literacy instruction.

A particularly important question is if the teacher trainees' suggested new practical solutions for information literacy instruction. Generally speaking, the teacher trainees' conceptions of the challenges in and their ideas for practical solutions were thematically coherent: they concerned similar issues. In other words, the teacher trainees were at least thinking about the same issues they had perceived as challenges in information literacy instruction. However, many teacher trainees suggested demonstrating the lower-order skills for seeking or assessing information sources, either by lecturing in general or guiding students in action by interventions. A few teacher trainees' alluded to the higher-order information literacy learning goals when suggesting ideas about how to get students engaged in processing information to avoid copying and pasting. That students would use a diversity of information sources and compare various information sources associate to the idea, although leading students into conflicting information sources was not explicitly articulated in the data. Many teacher trainees proposed ideas centred on the design of the task assignment. Some proposed using strict worksheets to control students' information behaviour but others questioning with varying degrees of openness. However, there was very little evidence that these teacher trainees had in mind the principles of inquiry learning, questions developed by students or interventions to guide the development of students' research questions. The suggested ideas to guide students in information seeking during the task-performance and information seeking instruction given apart of other areas of the learning assignment were focused on the use of the lower-order skills as well.

Some teacher trainees' ideas were indeed practical, reflecting their awareness of problems associated with implementing Web-based learning assignments, such as verifying the availability of relevant information sources in advance, keeping students occupied with what they are doing to keep the class in control and restricting access to preselected Web-sites. However, as concrete and practical as these ideas are, they do not advance information literacy instruction for inquiry learning. Some of the above-mentioned examples of the perceived challenges in information literacy instruction also reflect the same reality: students' (perceived) lack of skills, their lack of motivation and the lack of time for information literacy

instruction. These views can certainly hinder adopting the higher-order information literacy skills as learning goals.[22]

An aspect to consider is if the teacher trainees' focus on the lower-order skills was merely a response to their experiences of the classroom realities in the secondary schools and working within curricular restrictions. Hongisto and Sormunen (2010) found that a teacher in the case study was overloaded with various requests for help. Most of the teacher's responses comprised step-by-step instructions for solving problems on the students' behalf or ideas and encouragement for them to work independently. These strategies were chosen for their efficiency in the limited time available for a single student. The teacher was much less often able to absorb the students' problems to collaboratively solve them. (Hongisto & Sormunen 2010.) The teacher trainees observed, in line with the literature (Merchant & Hepworth 2002; Probert 2009; Williams & Wavell 2007), that they had little or no time for teaching information seeking and use in subject teaching. The lack of such fundamental resource such as time undermines the idea of teachers adopting the role of a student and participating in students' learning processes (*cf.*, Alexandersson & Limberg 2003), and explains why the teacher trainees might have found the teacher-centred position so persuasive in information literacy instruction (Hepworth & Walton 2009: 77–78).

The present findings corroborate research on practising teachers' conceptions of information literacy instruction. Research has shown that most teachers

- demonstrate various procedures and give general guidance for using the lower-order information skills and technical tools to access and assess information sources
- have only vague notions and underdeveloped strategies for teaching information seeking and use
- see information literacy instruction in isolation from subject teaching (Limberg & Folkesson 2006; Limberg *et al.* 2008; Lundh & Limberg 2008; Williams & Wavell 2007)

[22] It is possible too that the teacher trainees saw teaching of higher-order information literacy as a futile attempt and more as a personal characteristic of some of their students (see Limberg & Folkesson 2006).

- recognize various aspects of information literacy but focus only on the lower-order skills, where they think they can have control over their students' learning
- find tight curriculum schedules as obstacles to information literacy instruction in subject teaching (Williams & Wavell 2007).

The obvious similarities in the ways the teacher trainees and practising teachers think about information literacy instruction strongly suggest that the teacher trainees' were not thinking about using the Web as a new potential tool. The teacher trainees' ideas comprised mainly demonstrations of various procedures perhaps for the lack of better ideas how to use the Web for information literacy instruction in subject teaching. The lack of concrete strategies also implies that the teacher trainees had only vague conceptions of how to teach information seeking and use. The teacher trainees' own experiences of information seeking and use and their conceptions of information literacy instruction show some thematic overlap, but with obvious bias towards the lower-order skills. The teacher trainees apparently lacked conscious understanding of the skills and concepts involved in their own information acquisition and use, and therefore were not able to break them down and incorporate them as concrete steps for information literacy instruction (see Hepworth & Walton 2009: 229–230; Merchant & Hepworth 2002).

## 5.4 Value of the findings

The present findings have theoretical implications to the task-based information seeking and retrieval research, in addition to the empirical contributions discussed above. Study III demonstrates how several lessons planned continuously and even simultaneously trigger information acquisition not only within but also over the individual tasks. Lesson planning is an example of an iterative work task that triggers diverse modes of information acquisition, many of which are unattainable by the models of information seeking based on studies conducted in academic and workplace contexts. McKenzie (2003) points out that such models tend to describe only active information seeking for a single present task, and cannot capture information acquisition for several on-going interrelated present tasks, let alone for any anticipated tasks. The models derived from Kuhlthau's (2004) ISP are,

however, based on source-based writing assignments, which are typically performed in relatively unfamiliar problem areas in isolation from other similar tasks. The ISP was intended to describe only systematic information seeking over a series of stages in the confines of a single, present task. The task-based research modelling single tasks in isolation offers nevertheless little for conceptualizing keeping up and accessing personal collections in anticipation of (future) tasks or monitoring as a mode of information acquisition. Furthermore, the ISP describing learning driven information seeking from the cognitive point of view is not particularly useful for making sense of accidental encounters and passive modes of information acquisition.

The findings suggest the continuity between tasks of a kind and the interrelatedness of tasks within a profession (see Leckie *et al.* 1996) as research foci to capture across tasks perspective in task-based research, which has intensively scrutinized tasks in terms of stages (see Kuhlthau 2004) and complexity (see Byström 1999). It is worthwhile noting that the model proposed by McKenzie (2003) and exploited in Study III was developed for everyday-life information seeking. Exploiting the model, Study III also evoked the interesting elaboration of the two stages of access to information. The teacher trainees, like all professionals, have already established connections with various information sources over information channels when engaging in their tasks. They might know a book, which they need regularly but not very often, and borrow it every once in a while from a library. They also have connections to interpersonal resources such as their colleagues and mentor teachers, who might even be aware of their information needs and act as intermediaries, information channels or information sources to them, even without active requests for help. In such cases, the information seeker is not trying to locate relevant information sources but to use one.

Study III contributed in terms of conceptual analysis into the field of information seeking and retrieval studies. Each information channel was empirically described after careful consideration of the central idea or concept constituting the channel.[23]

[23] For example, it was necessary to consider the differences between the Web as an open collection of information sources, the Web as an infrastructure and a set of tools for providing information sources and searching information, and the Internet underlying as a set of technologies providing various information services, such as online library catalogues or other databases, independent of the Web. On these grounds, the rationale of not considering the use of OPACs as the use of the Web as an information channel was developed.

The task-based perspective provided the rationale for discerning between information channels and sources. The decision was made to consider only primary information sources directly contributing to the task proper (see Serola 2009: 106). Secondary information sources – such as abstracts, indexes and bibliographies – and various intermediaries accessed in information seeking were not reported in the findings as information sources. Information channels were also thought about in broad terms to encompass even direct observation, which lacks information sources in the conventional sense (see Serola 2009: 15, 70, 74, 104). Observation was included, because the teacher trainees were required to comment on other student teachers' lessons, and it enabled them to access contextual information that is not available from formal sources. Considering these, Study III gives a more realistic picture of from where teacher trainees get informed than the earlier studies on practising teachers' information seeking behaviour, which have typically taken information channels and sources as given, and contributed little in terms of conceptual development (*cf.*, Merchant & Hepworth 2002; Perrault 2007; Small *et al.* 1998; Summers *et al.* 1983).

The present findings also have practical implications. The assumption that future teachers will pass their information literacy onto their students is questionable. The major differences in the information literacy conceptions of different generations of teachers are illusory. Research shows that older generations of people are catching up the younger in the use of the Internet and the assumed generational differences are disappearing anyway (Todd 2008). Teachers' difficulties in developing strategies and effective practices for information literacy instruction are unlikely to be down to their lack of authentic experiences in using the new information and communication technologies for their own purposes. The problems of both practising teachers and teacher trainees are likely to originate in the lack of proper pedagogic training for exploiting the new information environment. Without training for information literacy instruction in the new information environment, teacher trainees seem to produce similar patterns of conceptions as practising teachers do. Growing up with the new information environment does not lead to new pedagogic innovations in itself. It is, therefore, not reasonable to assume that teacher trainees can translate their experiences of information seeking and use into effective pedagogic applications if this prospect is not included in teacher education curricula. There are benefits in providing training and guidance for teachers on how

to incorporate information literacy instruction into their teaching (Merchant & Hepworth 2002).

The teacher trainees seemed to lack a conscious understanding of the skills involved in information literacy. They would benefit from using concepts and models from information seeking and retrieval research to discern between various dimensions of information seeking and use in information literacy instruction (see Limberg & Sundin 2006). That the teacher trainees did not explicitly cite interpersonal resources, observations or visits as information channels, implies differences in the ways researchers and teacher trainees conceptualize information seeking. The present findings showing the full spectrum of the teacher trainees' experiences in information acquisition and use could inform teacher trainees how to exploit their own experiences in information literacy instruction. Teacher educators could utilize the findings as a framework to assess how teacher trainees' reflect on their information behaviour. The teacher educators could, for example, compare teacher trainees' experiences and their conceptions of the exploitability of the experiences. The teacher trainees' perceptions of the challenges in and their ideas for learning exercises could be contrasted as well.

There are some practical implications for curricular designs as well. Information literacy instruction would be best implemented as an integral part of subject teaching, where inquiry learning and information literacy instruction can be meaningfully integrated. The finding in Study IV that some teacher trainees perceived that they had little or no time for teaching information seeking and use as a part of their duties as subject teachers is particularly relevant. They might have found information literacy instruction as external to subject teaching and, therefore, as something that takes valuable time from subject teacher's primary duties. In other words, the ways schools organize teaching might not be very supportive to information literacy instruction. Current curricular designs hardly support, for example, students' monitoring as a mode of information acquisition. The conflict between information literacy instruction and curricular demands has been noticed in past research as well (Williams & Wavell 2007). Hongisto and Sormunen (2010) offer an illustrating case example of the issues related to organizing inquiry learning within the practical realities of the traditional school curriculum. Kuhlthau *et al.* (2007: 93–109), on the other hand, offer some practical ideas for meeting content

area curricular standards in inquiry learning, and Hepworth and Walton (2009: 127–225) provide examples of learning assignments for information literacy instruction.

The present findings are unlikely to be a consequence of some unique characteristics of the respondents or the circumstances. Studies II–IV covered a variety of data sources including three different groups of teacher trainees majoring in history, social sciences, psychology and philosophy, instructed by two different teacher educators, and the data were collected in two academic years. However, the subjects covered by the findings are particularly suitable for embedding information literacy learning goals. The findings are unlikely to be transferable to, for example, mathematics education, which may still be based on textbooks. On the other hand, the subjects covered by the present data did not include literature, which is arguably even more easily adaptable to information literacy instruction. An important consideration is to avoid generalizing the findings to practising teachers. Practising teachers are unlikely to need observation for contextual information unless they are changing schools, and even then they might prefer interpersonal channels. There is also direct evidence that the more experienced teachers seek information to enhance existing, already well-formed lesson plans in their portfolio, and therefore simply need less information than beginning teachers (Lawley 2011: 33).

# 6. Conclusion

The overarching goal of the present thesis was to find out how teacher trainees' ways to acquire and use information for a work task are related to their conceptions of information literacy instruction. The most important finding of the thesis is that the teacher trainees accessed a diverse selection of information channels and sources in lesson planning, adopting various modes of information acquisition, but conceptualized the rich variation of experiences only superficially in their conceptions of information literacy instruction.

The findings show that the teacher trainees were unable to respond to the challenges of information literacy instruction on the basis of their own experiences, in spite of their fluency in information acquisition and use. The findings suggest that teachers' difficulties in developing effective practices of information literacy instruction do not stem from lack of authentic experiences in using the new information and communication technologies. The problems of both practising teachers and teacher trainees seem to originate from the lack of relevant education to teach in the new information environment. Consequently, the problems affecting information literacy instruction in schools are not going to resolve themselves over time.

The findings have implications for pedagogic approaches adopted in teacher education to prepare teacher trainees for information literacy instruction. The teacher trainees' in-practice theories concerning teaching information seeking and use were under-developed, contrasted to research-based information seeking models. The teacher trainees were unaware of the models applicable in information literacy instruction and, therefore, lacked useful conceptual tools for critical reflection on their in-practice theories. The contributions of Kuhlthau, Limberg and others have not gained attention in teacher education. Neither have the principles of inquiry learning a distinctive role in teacher education. The information seeking and retrieval researchers offer ideas for teachers on how to design learning assignments for inquiry learning in schools and intervene into students' learning processes.

Incorporating this body of knowledge into teacher education would help teacher trainees develop their in-practice theories for effective information literacy instruction practices.

The present findings suggest several intriguing topics to be addressed in the future. Teacher trainees' conceptions of information literacy instruction should be addressed more systematically and with a larger sample. More recent data comprising participants from diverse subjects could also elaborate the findings. A design research approach could be adopted in cooperation with teacher educators to implement information literacy as a distinctive goal in subject teaching.

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# Appendices

Appendix 1. Interview guide of the Study II[24].

1. Describe an example of a lesson planning related problem-solving or decision-making situation, in which you recognized the need to and succeeded or failed to find information.
    a. From where did you seek information in this situation?
    b. How did you seek information in this situation?
    c. What kind of conception did you have of the information you needed in this situation?
    d. By what criteria did you assess the usability of the sources you found?
    e. How and for which purpose [did you use[25]] information in this situation?
    f. To what extent were you able to use information directly, or to what extent did you have to process it?
    g. Which of the information sources used in this situation were used in the final lesson plan?
2. Did you use all the information gathered for the lesson plan? If not, which sources did you not use?
3. Were you able to support your original ideas with the retrieved information or did you have to modify your ideas according to the information you were able to find?
4. What do you think you have learned about information seeking and use in lesson planning?

[24] Translated from the Finnish original.
[25] Original phrasing fixed.

Appendix 2. Interview guide of the Study III[26].

1. What learning goals did you set for the pupils/students in the lesson plan?
2. What issues did you consider important to take into account when planning this lesson?
3. Could you describe in general how the lesson was planned?
4. For what purposes did you seek information when planning the lesson?[27]
5. When seeking information for [the purpose][28],
    a. at what stage of lesson planning did this occur
    b. from what sources did you seek information
    c. where did you access these sources?
    d. in which order did you seek information from these sources?
    e. how did you seek access to these information sources?
    f. on what grounds did you assess the suitability of the information sources you did find?
    g. did you adapt the original materials and if you did how / what did you learn from this information?[29]
6. What kind of lesson planning related work approaches do you have?
7. Do you store or save documents sought for lesson plans for future needs?
8. How do you organize the stored materials?
9. How much time did it take to plan the lesson?
10. Were you satisfied with the materials that you found for the lesson plan?
11. What did you learn about information seeking and use when planning this lesson?

[26] Translated from the Finnish original.
[27] The observations conducted were exploited at this point if necessary.
[28] The set of questions (5a–5g) were iterated for and adapted to each purpose.
[29] There are two variations of the question because what the trainees did to or did with the information depended on the purpose for which it was sought.

Appendix 3. Interview guide of the Study IV[30].

1. What was most challenging in seeking and using information in the making of lesson plans?
2. What did you learn from lesson planning that you could apply in teaching information seeking and use skills to students?
3. What would you consider the major challenge in teaching information seeking and use skills to students?
4. How would you plan a learning exercise in which students use mainly the Internet as an information source?

[30] Translated from the Finnish original.

# Original publications

# A critical review of research on information behavior in assigned learning tasks

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## Abstract

**Purpose** – This paper aims to give a critical review of the empirical information seeking and retrieval (IS&R) literature focusing on learning related information behavior. It also aims to propose the task-based approach to link research on learning and information behavior in learning tasks and utilized to organize and interpret the literature.

**Design/methodology/approach** – This paper takes the form of a critical literature review.

**Findings** – Researchers have identified patterns of information behavior and variations in the conceptions of seeking and using information for learning tasks. The results are fragmented and a framework should be developed to guide further research. Learners' information behavior in learning tasks may be attributable to various explanatory factors, which have not been taken into account in any single study. The concept of focus formulation appears to link information seeking and learning. The role of the writing process in learners' information behavior and the characteristics of the resulting documents have received least attention in the research field.

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**Research limitations/implications** – The review emphasizes task-based IS&R literature. Learning research may shed more light on specific questions.

**Practical implications** – The paper may help teachers in designing learning tasks.

**Originality/value** – The paper provides a synthesis of recent studies on information behavior in learning tasks and identifies new paths for further research.

**Keywords** – Information retrieval, Learning, Individual behaviour

**Paper type** – Literature review

# 1 Introduction

The world wide web (later the web) is an easily accessible and ubiquitous information environment, which has reshaped people's information behavior by enabling instant information searching in various contexts (see e.g. Bilal, 2004; Bilal & Kirby, 2001; Fidel et al., 1999; Savolainen, 1999). The web has become an important information resource in teaching and learning at all levels of formal education (Bilal & Kirby, 2001; Chen, 2003). It is an open-ended information environment, which complements and extends traditional learning materials. Instant access to the web's information resources has radically enlarged the information space available to the learner (Rogers & Swan, 2004; Walton & Archer, 2004).

The seemingly easy access to a wealth of information resources is a challenge as well as an opportunity. Easier access to information does not automatically mean better learning outcomes. The effect can be counter-productive. Studies on learners' information behavior suggest that pupils and students often search documents for the "right" answers copying and pasting pieces of text instead of constructing and articulating their personal understanding. Novice learners without a clear conception of what they are doing face difficulties in assessing the quality and validity of information searched. (Alexandersson & Limberg, 2003; Hultgren & Limberg, 2003; Limberg, 1999; McGregor & Streitenberger, 2004.)

The problems mentioned above can and should be examined from the viewpoints of information seeking and retrieval (IS&R) research and of learning research. In this paper, we focus on the IS&R literature and adopt the task-based approach (see Ingwersen and Järvelin, 2005; Vakkari, 2003). The task-based approach seems a convenient choice, since learning assignments can be regarded and studied as information intensive work tasks (see Ingwersen and Järvelin, 2005). The strength of this approach is that it can develop shared conceptual frameworks with research on learner-centered instructional methods. Tasks are a growing research area, yet the focus of the studies seldom extends to the actual use of information or the learner's ways of understanding information content (see Alexandersson and Limberg, 2003; McGregor and Williamson, 2005; Spink and Cole,

2006; Vakkari, 1997). On the other hand, past research on learning cannot give us a clear picture of the relationships between information behavior and learning. For example, in the models of problem-based learning, information seeking may be presented as a black box in the learning cycle but the box is seldom opened for a detailed analysis (see Poikela and Poikela, 2005).

Our interest in learning tasks originates from the goal of developing information literacy instruction. Effective seeking and use of information are included in information literacy standards such as ACRL[1], ANZIIL[2] and SCONUL[3] as necessary premises for intellectual access to information and learning to learn. This motivates us highly to focus on the characteristics of learning tasks, which could foster the learner's motivation for information literate behavior (see Edwards and Bruce 2004).

This paper contributes to the inadequately explored area of IS&R research and learning research. Research on information behavior in learning tasks is scattered and difficult to represent coherently. To clarify related issues we propose (1) the task-based IS&R research approach to learning tasks and (2) a research framework to organize and interpret research on information seeking and use in learning tasks. The paper is organized as follows. First, we discuss the task-based IS&R approach to learning tasks. Next, we review empirical IS&R research focusing on information behavior in learning tasks. Finally, we summarize our findings and present a model visualizing the research framework for learning-related information behavior.

## 2 Basic concepts, models and approaches

The aim of this section is to elaborate the basic concepts of learning task, information behavior and task-based IS&R research. We conclude by presenting a process model characterizing the core concepts and information related processes involved in the performance of a learning task.

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[1] http://www.ala.org/ala/acrl/acrlstandards/informationliteracycompetency.cfm
[2] http://www.anziil.org/resources/Info%20lit%202nd%20edition.pdf
[3] http://www.sconul.ac.uk/groups/information_literacy/papers/Seven_pillars2.pdf

*2.1 Learning task*

In this paper, learning task is defined as a teacher-designed but learner-centered teaching and learning activity focusing on a specific area of knowledge. The aim of the learning task is to help the learner to achieve specified learning outcomes by active information processing (as a cognitive activity) in interaction with the learning resources available. Learning tasks range from simple exercises (e.g. apply a given mathematical formula to given data), via essay writing (e.g. collect information about a given topic and compose a review) to complex projects (e.g. identify and define a problem, and develop an evidence-based solution to it) (Ford, 2004; Goodyear, 2001).

We are primarily interested in cognitively demanding learning tasks, which emphasize the learner's responsibility for seeking information. Writing essays or theses and conducting tutored case studies or research projects are examples of such learning tasks. For example, project-based, inquiry-based, resource-based and problem-based instruction is typically organized in the form of learner-driven research projects. As learners we have mostly pupils (i.e. school children) and senior high school students in mind, but as the research on the topic is scarce, research involving university students is also utilized.

The point of departure of a demanding learning task is a specified problem or scenario, which is sufficiently open-ended to allow a variety of responses or solutions. Learners need to provide the solutions relatively autonomously over extended periods of time, perhaps in collaboration with others. Teachers assign the task, facilitate the process and offer assistance, but learners pursue their own lines of investigation. Note taking, writing and organization of information are important parts of the learning task. Learners need to learn how to identify what information is important to them, construct new meanings, and explain their new understandings to others as documents, presentations or artifacts in a way that is authentic to the topic. (Eskola, 2005; Gordon, 1999; Jonassen et al., 1999; Kahn and O'Rourke, 2005; Kavli and Mikki, 2006; Kuhlthau, 2004; McGregor and Streitenberger, 2004; Thomas, 2000.)

Learning tasks are triggered by a learning assignment. The learning assignment is more than just a piece of text. It incorporates the whole process in which the task is introduced to the learners. (McGregor and Streitenberger, 2004.) The learners are encouraged to

construct an understanding of what the task is about and commit to the cognitive activity needed to achieve the desired learning outcomes (Gordon, 1999; Thomas, 2000; Petraglia, 1998). The learning assignment defines the requirements for the final documentary or presentational product of the task and may also specify how different stages of the task are to be conducted (McGregor and Streitenberger, 2004). Final reports are typically the physical output of a complex learning task and a tool for the teacher to assess the learner's progress (Gordon, 1999).

### *2.2 Information, information objects and information behavior*

Buckland (1991) distinguished between intangible knowledge (i.e. information-as-knowledge) and tangible information objects representing that knowledge (i.e. information-as-thing). Ingwersen and Järvelin (2005) refer to this differentiation as the linguistic level of signs and at the cognitive-emotional level of the individual. Information is the result of a transformation of the author's knowledge structures into information objects, and something which, when perceived and interpreted, affects and transforms the interpreter's state of knowledge. (Ingwersen and Järvelin, 2005.)

Wilson (1999) defines information behavior as the "activities a person may engage in when identifying his or her own needs for information, searching for such information in any way, and using or transferring that information." It is also common in information studies to make a distinction between information seeking and information searching, where the former is regarded as an overall human activity in acquiring information through various channels and the latter is associated with the use of a specified retrieval system (Wilson, 1999; Ford, 2004; Marchionini, 1995).

Wilson (1999) refers elegantly to different types of information use by the terms "use" (when information is interpreted) and "transfer" (when information is used as an object). Alexandersson and Limberg (2003) allude to the same difference in information use by a triplet: (1) transportation (e.g. copying and pasting), (2) transformation (e.g. paraphrasing the original document) and (3) reformulation (e.g. completely rewriting the original text in one's own words) of the original document. In the strict sense, information use implies that information has been incorporated into the individual's existing knowledge structures

(Spink and Currier, 2006). Information use goes beyond the manipulation of information objects into mental information processing (Buckland, 1991) and construction of knowledge (Bartlett and Toms, 2005; Todd, 2005).

Ingwersen and Järvelin (2005, p. 21) define information behavior more generally as "[h]uman behavior dealing with generation, communication, use, and other activities concerned with information." In the context of learning this is a relevant conceptual extension. Information can be acquired not only through documents but also by developing ideas, observing the environment and making inferences (Ingwersen and Järvelin, 2005, pp. 47-54). Further, writing and composing documentary presentations has become a standard tool used to support learning (Kieft et al., 2006; Lonka et al., 2001, Jonassen et al., 1999; Nelson, 2001). In this paper, information behavior is understood in the traditional sense of accessing and interacting primarily with formal information sources (e.g. documents) since the IR&S literature reviewed seems to follow this line of thought.

### *2.3 Task-based approach to information seeking and use in learning tasks*

A task may be understood as a description of a goal, a purpose, implementation methods, requirements and a meaningful outcome. The task description directs the actor to *perform* a particular sequence of actions entailing physical, affective and cognitive dimensions. (Byström and Hansen, 2005; Hansen, 1999; Ingwersen and Järvelin, 2005; Pharo, 2002; Vakkari, 2003.) A complex task may comprise several subtasks – each with their own requirements and goals – in support of the main task. Information seeking and searching are typical subtasks of information intensive tasks. (Byström and Hansen, 2005; Hansen, 1999; Ingwersen and Järvelin, 2005; Vakkari, 2003).

The task is a different focus of research in contrast to the environment and the individual.

- The environment comprises social norms and values, purposes and goals, routines, constraints, and available information and personnel resources among other such characteristics creating stable conditions for tasks (Byström and Hansen, 2005). In learning related IS&R research environmental characteristics such as the teaching method and discipline have been studied as influences on information behavior. These

studies have focused on groups of learners seeking information in general rather than for specific tasks (see e.g. Eskola, 2005; Kerins et al., 2004; Rowley and Urquhart, 2007).

- The individual is characterized by, for example, preferences, experiences, general motivation (e.g. motivation to study), and awareness of environmental and situational factors influencing task performance (Byström and Hansen, 2005). Personality and learning styles are among the characteristics that have been studied as influence on the learner's information behavior (see e.g. Ford, 2004; Heinström, 2002).

- The characteristics of the task process, such as the task performer's subject knowledge and motivation (related to the task), are of a transient nature and vary through the task (Byström and Hansen, 2005). Research focusing on the task (see e.g. Kuhlthau, 2004; Vakkari, 2001) has resulted in general models explaining changes in learners' cognition, emotions and information behavior during task performance. Other researchers have adopted phenomenography as the research approach to study variation in learners' experiences of seeking information for specific learning tasks (see e.g. Limberg, 2005). This view on tasks implies that the learners' ways of experiencing the characteristics of the task determine variation in information seeking (Limberg, 2007).

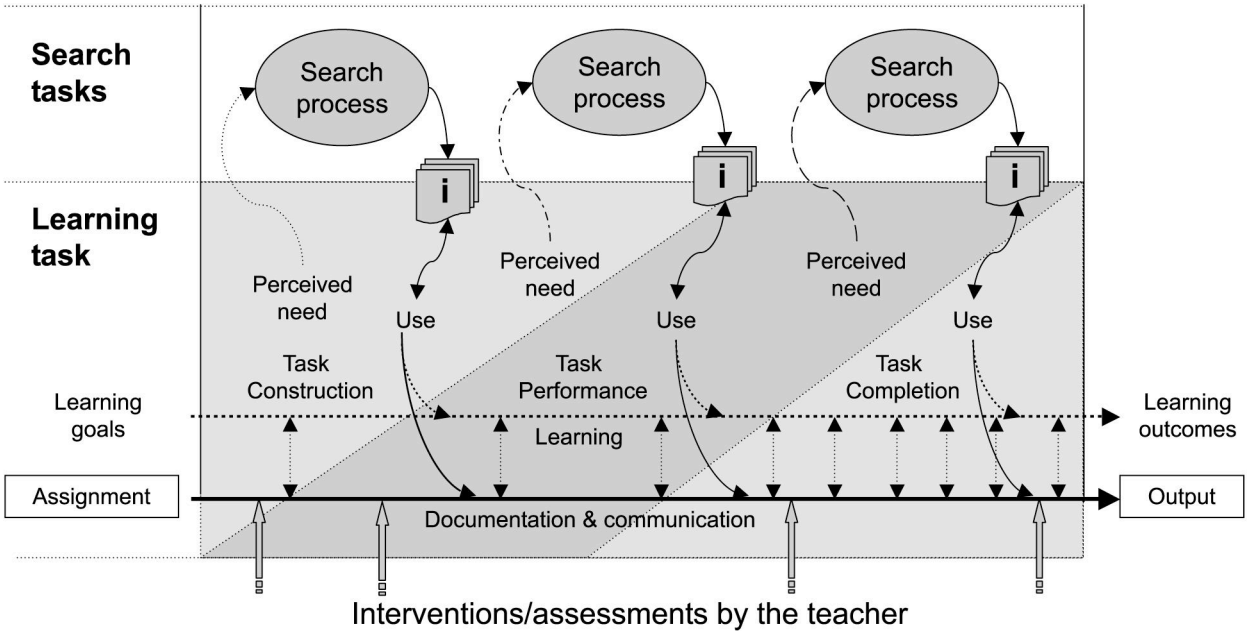
Kuhlthau's (2004) model of information searching process (ISP) is an empirically verified framework explicating, in terms of constructivist learning theory, the learner's experience of seeking information for learning tasks. The model predicts that a successful learner seeking information experiences a transition from uncertainty to understanding through several stages. Each stage is characterized by particular thoughts, feelings, and actions. The model, when adapted for researcher–teacher communication, can offer a theoretical basis for interventions into the learner's information seeking based on the learner's stages in task performance. (Kuhlthau, 2004.)

### *2.4 Process model for IR&S in learning tasks*

We propose a process model for learning task related information behavior based on the definition of the learning task and the task-based viewpoint outlined above. The process

model represents the essential components in the problem area. It illustrates the viewpoint of an individual learner performing a self-regulated learning task.

**Figure 1.** A model characterizing information behavior in assigned learning tasks




The teacher designs (i.e. describes) the learning task by defining learning goals (i.e. desired learning outcomes), implementation methods, and requirements for the task output. The assignment is the guideline for learners to work on the learning task. The output of the learning task may be a document, presentation or any artifact specified in the learning assignment.

The learning task consists of three partially overlapping stages: task construction, task performance, and task completion (see Byström and Hansen, 2005). The figure depicts how information needs are perceived during the learning process and information is retrieved, selected and used to accomplish the learning task. The broken lines drawn from the learning task level to the ovals depicting search processes represent the prediction that situational characteristics such as the learner's increasing knowledge will influence information searching.

The learning process, illustrated by the broken line, is the core process but is not open to direct observations. IS&R researchers have adopted the cognitive constructivist view from learning research: learners are seen as producers (and reproducers) of knowledge

rather than its receivers and senders. The learner's understanding of the topic, a cognitive structure, is seen as the foundation consisting of concepts and their relationships. Learning is about the restructuring and expansion of the existing construction. The cognitive structure becomes increasingly more specified and complex as knowledge of a subject matter increases. The more interrelated concepts to differentiate in the aspects of topic, the more the learner knows, and the more focused statements she is able to make on the topic. (Ford, 2004; Kuhlthau, 2004; McGregor and Williamson, 2005; Todd, 2006; Vakkari, 2001; cf. Nelson, 2001.)

Documentation and communication processes produce graphically recorded verbal constructs, which make learning indirectly observable (see Nelson, 2001). Notes, learning diaries, written communication and the task output are examples of documents (Kavli and Mikki, 2006; Kuhlthau, 2004, pp. 140-141). The teacher may intervene in the learning process on the basis of the learner's documentation process. For the sake of simplicity, the model does not make the individual learner's collaboration with co-learners explicit, although we do not discourage such an interpretation of the model.

## 3 Empirical IS&R studies on learning tasks

In this literature review we cover studies focusing on the characteristics of and the relationship pertaining between the learning task and its information related subtasks. However, we recognize that studies focusing on the influence of a learner's personality on information behavior are too important to set aside. Researchers taking that approach have identified patterns in information behavior that correspond with findings obtained in task-based studies. Thus we have discussed learner characteristics that have been shown to relate to learning task characteristics with respect to information behavior.

The characteristics discussed in the review have been empirically studied as dependent or independent variables, but, where empirical research was not available and the issue at hand seemed important, (pre-)theoretical, non-empirically tested characteristics were discussed as well. Rather than attempting an exhaustive literature review covering all studies published on the subject, and meticulously restricting ourselves to empirical results, we aimed to outline a research framework for the learner's information behavior

in learning tasks. The characteristics are organized into classes or research dimensions according to the classification scheme introduced in the Integrated IS&R Research Framework by Ingwersen and Järvelin (2005, pp. 313-316; see also Pharo, 2002):

- Actor Dimensions → Learner Dimensions (LD)
- Organizational Task Dimensions → Learning Task Dimensions (LTD)
- Access and Interaction Dimensions (AID)

The document dimensions and algorithmic dimensions identified by Ingwersen and Järvelin were ignored at this point. This helped to keep the review manageable and to enable the core aspects of the problem area to be studied in sufficient detail.

### *3.1 Learner dimensions*

#### *Cognitive mental states*

Mental states are relatively stable and persistent characteristics of individuals representing both the cumulative results of and influences on their information behavior. Mental states may affect the ways learners approach learning tasks and their ability to execute them. Cognitive mental states are associated with knowing and reasoning. (Ford, 2004.)

A number of researchers have been interested in how prior subject knowledge influences information behavior. Prior subject knowledge refers to the learner's familiarity with the semantic subject content and to her ability to articulate it. It influences the learner's understanding of the learning assignment. Learners with prior topical knowledge are better able to formulate their own research questions, identify resources, and choose search terms. (Ford, 2004; Hultgren and Limberg, 2003; see Alexandersson and Limberg, 2003; Kuhlthau, 2004, pp. 94-96; Vakkari, 2000, 2001.) Hence, learners use the internet with confidence and expertise with regard to their own interests but seem to feel uncertain and incompetent when trying to seek information for assigned topics about which they know very little (Hultgren and Limberg, 2003). Hultgren and Limberg (2003) following Kuhlthau (2004), suggest that these experiences are associated with lack of prior subject knowledge, focus and a personal point of view at the early stages of the ISP.

The facility for critical thinking characterizes learners who tend to perceive multiple interpretations of each situation, acknowledge that some things are contradictory, engage in reasoned evaluation of information supporting different interpretations, and develop personal commitment to one interpretation or synthesize competing interpretations. Critical thinking skills – as opposed to a mere facility – can be either fostered or suppressed by the teaching methods prevailing in the learning environment, but the interrelationship between the facility and training for critical thinking has been shown to be self-reinforcing. (Ford, 2004; Heinström, 2002, pp. 19-20; see Eskola, 2005.) For example, in Heinström's (2002, pp. 229-230) data critical thinking manifested in the judgment of information as a preference for a wide and diverse set of sources offering new perspectives, allowing contrasting viewpoints and the making of quality assessments between sources. According to Eskola (2005) a problem-based curriculum provided students with learning experiences of this kind more often than conventional lecture-based curriculum.

| *Research dimension* | *Variables and non-operationalized characteristics* |
|---|---|
| LD: cognitive mental states | prior subject knowledge (i.e. domain knowledge), critical thinking skills |

*Affective mental states*

Affective mental states comprise of the learner's emotions and attitudes. They may, like cognitive mental states, be analyzed as effects of information behavior or as influences on that behavior. (Ford, 2004.)

Many researchers have addressed the importance of motivation (to study). Rezabek (1995) operationalized motivation as a combination of the sense of control, success, satisfaction, and the importance of the activity to the learner. Motivation fuels the learner's initial receptivity to the learning assignment and drives information seeking and analysis. Extrinsic motivation is driven by reinforcements external to the learner, such as fear of failure or desire for success. Intrinsic motivation does not require rewards to sustain it, because the will to explore the topic of the task originates in the learner's own

curiosity and authentic information needs. (Beheshti et al., 2005; Eskola, 2005; Ford, 2004; Hultgren and Limberg, 2003; Heinström, 2002, pp. 112-113; 2006a, 2006b.)

Self-efficacy is a concept used of the learner's perception of her ability to organize and execute actions. Perceived self-efficacy influences the activities undertaken, the efforts exerted for them, the persistence in taking those actions, the emotional responses to the actions, and the actual attainments of the actions. Individuals demonstrate an enduring interest in activities at which they feel self-efficacious. Outcomes of actions support or undermine self-efficacy creating positive or negative cycles, but positive self-efficacy is not necessarily followed by the motivation to utilize it. Self-efficacy has been linked to such aspects of motivation as fear of failure and intention to excel. (Ford, 2004; Savolainen, 2002.) Low self-efficacy may also explain why some learners give up information seeking after encountering the first difficulties (see Heinström, 2002, p. 211).

| *Research dimension* | *Variables and non-operationalized characteristics* |
|---|---|
| LD: affective mental states | type of motivation, self-efficacy |

*Learning styles*

Ford (2004) and Heinström (2002, pp. 45-61) review the research on the influence of learning styles on information behavior. Learning styles are preferences to perform intellectual activities in particular ways in knowledge acquisition contexts (Heinström, 2002, pp. 45-46). Whether learning styles are based on innate psychological characteristics of the individual or vary from task to task has been debated intensively (Heinström, 2002, p. 61). The cognitive personality is the most stable conception of learning styles. It comprises the dimensions representing the (relative) breadth or narrowness of information processing and the dimension representing the learner's preference to think either in words or images. For example, (w)holists examine interrelationships between several topics in order to build a broad conceptual overview into which to fit details, serialists examine one (sub)topic at time thoroughly and then seek logical sequences linking these topics. Learners with a strong predisposition to the

extremes of either dimension may be disadvantaged in learning tasks favoring the opposite. (Ford, 2004; Heinström, 2002, pp. 45-52.)

The study approach is a learning style mediating between situation and personality. It is a function of a motive and a strategy adjusted to the situation. Learners with the surface approach are extrinsically motivated by fear of failure. They intend to complete the task with as little effort as possible. The task is viewed as an external imposition devoid of personal meaning. Facts are learned by rote and memorized to fulfill a momentary information need rather than to expand existing knowledge with new ideas. Information is accepted uncritically. The strategic approach is characterized by an intention to complete task requirements with the highest possible grades through systematic allocation of time and resources. The learners taking this approach try to discern what the teacher requires[4] and organize their efforts. The learners with the deep approach are intrinsically motivated with the intention to create personal understanding of information content. They have a critical stance towards information. They relate information to their prior knowledge, personal interests and experiences. (Heinström, 2002, pp. 55-64; 2006a; 2006b; Ford, 2004.)

| *Research dimension* | *Variables and non-operationalized characteristics* |
|---|---|
| LD: learner's approaches | cognitive personality, study approach |

*3.2 Learning task dimensions*

*Learning environment*

We use the learning environment as a broad label to discuss contextual characteristics influencing how learners interpret learning assignments. These characteristics include

[4] A good example: Hultgren and Limberg (2003) found that pupils did not use other media than text if not explicitly required to do so by the teacher, because the pupils assumed that their teacher required text documents. This rendered images and audio unusable for the pupils.

teaching methods, discourses providing the language for speaking about learning assignments, and collaboration between learners.

Eskola (2005) studied the differences in university students' information behavior in a conventional curriculum dominated by lectures and in a problem-based curriculum where students worked in small groups facilitated by a tutor. The problem-based curriculum challenged students to generate problems, which demanded extensive information seeking from various sources. The students studying with the problem-based curriculum, in contrast to the traditional curriculum, perceived more often that they got instruction in critical thinking and judgment of information sources. They used a richer set of sources and more advanced criteria to evaluate information sources and reported more frequently on learning situations, which provided opportunities to change ideas or to present different views. (Eskola, 2005; see Heinström, 2002, p. 62.)

Although the development of learners' critical thinking abilities is the stated learning objective for many curricula, teaching and assessment of learning often reward conforming ideas and demand memorization of facts and details, which stifle critical thinking rather than encourage it. Learners may come to feel that there is a conflict between good grades and learning. (Heinström, 2002, pp. 20, 63.) Research indicates that according to prevailing discursive practices school assignments do not require genuine research but performance according to a script. Instead of developing research questions and pursuing genuine problem-driven research, pupils tend to mechanically seek, compile and report facts regardless of the nature of the assignment. Rather than spending time on formulating research questions and making plans, the pupils search for others' answers to someone else's questions and compile them into the required task output. Hence, the school environment tends to orientate pupils towards the products of their tasks rather than the process of learning. (Alexandersson and Limberg, 2003; Bilal, 2004; Gordon, 1999; Hultgren and Limberg, 2003; Kuhlthau, 2004, p. 43; Limberg, 1999; Limberg, 2005.)

Alexandersson and Limberg (2003) found that the social relationships of pupils did not encourage collaboration beyond information seeking. The pupils worked individually with the documents retrieved. A common focus on meaning was lacking. Apparently the pupils did not utilize each other's knowledge to seek specific information. The pupils

were concerned with getting pieces of information quickly from their peers rather than sharing experiences and coordinating their efforts with them. (Alexandersson and Limberg, 2003.)

| *Research dimension* | *Variables and non-operationalized characteristics* |
|---|---|
| LTD: learning environment | teaching method, discursive practices, collaboration |

*Learning assignment*

Schoolchildren tend to perceive school assignments as an imposition. They try to complete the assignments as quickly as possible. (Hultgren and Limberg, 2003.) Various studies have attempted to identify characteristics that would foster pupils' motivation to work actively, autonomously and collaboratively on the learning task at hand (see e.g. Rezabek, 1995). The fact that literature reviews – including this one – mostly report superficial information behavior is in itself a proof of how assigned learning tasks often fail to motivate pupils (see Alexandersson and Limberg, 2003; Hultgren and Limberg, 2003). [5]

Research indicates that pupils tend not to understand the nature of learning assignments. A genuine research-based assignment is reduced to a reporting exercise if learner involvement is limited to information gathering and presentation without any attempt to synthesize information. Reporting means seeking other peoples' answers to someone else's questions. Research requires learners to collect their own data and make sense of it in their own frame of reference. Assignments of an open and extensive nature and (perceived) lack of time to pursue them fail to engage pupils' interest. On the contrary, they encourage pupils to accept information uncritically, plagiarize it, and change the topic if information is not easily found. (Alexandersson and Limberg, 2003; Gordon, 1999; Hultgren and Limberg, 2003; see Kuhlthau, 2004, p. 68.)

[5] The literature discusses learning assignments mostly at (high) school rather than university level.

Researchers have recommended that teachers and instructors should make sure that learners have means to carry out learning assignments. There should be information resources available that the learners can use. The assignment should foster the development of personal viewpoints to become meaningful for learners. It should put learners into situations where they come into contact with differing viewpoints to make critical thought and analysis more inevitable. It should also be adapted to the cognitive development and prior knowledge of learners, because learning proceeds primarily from the learner's prior knowledge and not from material presented. (Beheshti et al., 2005; Hultgren and Limberg, 2003; Eskola, 2005; Ford, 2004.) These recommendations offered in the literature suggest that the extent to which learning assignments have been adapted to the learners' should be considered as a factor influencing learners' responses to the assignments.

| *Research dimension* | *Variables and non-operationalized characteristics* |
|---|---|
| LTD: learning assignment | perceived assignment, openness–specificity (the nature), adaptation to the learners |

*Learning and documentation processes*

Although Kuhlthau (2004) did not explicitly represent learning in the model of the information search process (ISP), the model elaborates learning in interaction with information. The exploration stage in the information seeking process, as explicated by the model, is characterized by deepening interaction with retrieved information content. Vague thoughts and the feeling of anxiety involved in the exploration of a general topic persist until the learner is able to direct information seeking to a particular aspect of the topic. In the focus formulation stage the learner concentrates on available information to choose a theme to focus on rather than to seek more information on a general topic. The formulation of the focus is experienced as a parallel shift in cognitive and affective realms, wherein thoughts shift from vagueness into focusedness and feelings from anxiety to confidence. (Kuhlthau, 2004, pp. 37-51, 64-68, 81-84.)

The model predicts that motivation increases and intellectual engagement with information intensifies after the formulation of a focus (Kuhlthau, 2004, pp. 101-103). However, Kuhlthau (2004) found that many learners sought information for unfocused topics and moved prematurely to complete their tasks without having achieved clarity and understanding. They remained uncertain and anxious throughout the process. The failure to focus may reflect a view of information seeking as locating information sources and gathering facts rather than interacting with information to transform it into personal knowledge. Seeking the "right" answer to a specific question is an impediment to focus formulation, because the right answer depends on what each learner needs to know in a particular situation to advance in the learning task. (Kuhlthau 2004, pp. 68-69, 94-95.)

Alexandersson and Limberg (2003) investigated pupils' use of the school library and discovered that, rather than seeking meaning, most pupils tended, from the beginning of their tasks, to orientate towards the final product of the task. The interaction between pupils and documents was limited to rewriting of the originals into an acceptable form, which preserved the structure of the originals. The pupils picked up words and expressions from source documents for the report and then added some of their own. (Alexandersson and Limberg, 2003.)

Learners who comprehend the learning task as a reporting exercise orientate towards the product. They try to make the product fit into a preconceived mold based on their prior experience and perception of the task requirements. Product-orientated learners do not perceive inquiry or creativity as part of the learning task. They copy and paste a great deal from the few original sources they use. They demonstrate little or no awareness of seeking meaning, making sense, or learning, and exhibit a strong desire to make the final product "look good" or "sound right". (Alexandersson and Limberg, 2003; Gordon, 1999; Hultgren and Limberg, 2003; McGregor and Streitenberger, 2004; McGregor and Williamson, 2005.)

The learners who comprehend the assignment as encouraging genuine research orientate towards the process of learning. They attempt to seek meaning, make sense and learn. They internalize their topics and sustain interest in them. The process-orientated learners tend not copy directly from their sources. They paraphrase, summarize and synthesize information. They are also better at using direct quotations than the product-orientated

learners, but use them less. (Alexandersson and Limberg, 2003; Bilal, 2004; Gordon, 1999; Limberg, 2005; McGregor and Streitenberger, 2004; McGregor and Williamson, 2005.)

Learners' interaction with retrieved and self-produced documents have not been a focus in IS&R research. Kuhlthau's (2004, p. 80) longitudinal case studies demonstrated that learners take notes and underline photocopies to support learning, develop marking systems for documents to organize information, and outline ideas to organize for writing. These functions can be linked with the stages of Kuhlthau's ISP to a certain extent. For example, detailed note taking indicates orientation to a closure, which is premature before the formulation of the focus. (Kuhlthau, 2004, pp. 47-49, 80.)

IS&R studies on learning tasks do not address the issue empirically, but nevertheless they do give some tips on how the teacher could intervene in learners' information behavior. The teacher could raise awareness of the sequence of thoughts, feelings, and actions commonly experienced in the learning process; provide situations that promote the formulation of a focus; offer opportunities to experience increased interest during the task performance by reserving enough time. Further, the teacher could encourage, reassure, advise and exhort especially those learners who are extrinsically motivated. Curiosity might be fostered with well-timed hints and clues helping to solve the problems. Further, the teacher could take the role of a learner, participate in and contribute to the other learners' knowledge construction, and encourage open negotiation about what is meaningful. (Alexandersson and Limberg, 2003; Beheshti et al., 2005; Eskola, 2005; Kuhlthau, 2004, p. 86; Limberg, 2005.) It is worthwhile noting that, while strong condemnations of plagiarism and instructions given for appropriate citation do not eliminate the behavior, they cause learners to at least try to hide the most blatant examples of plagiarism (McGregor and Streitenberger , 2004).

| *Research dimension* | *Variables and non-operationalized characteristics* |
|---|---|
| LTD: learning and documentation process | stage of the learning task, orientation, quality of information use in the documentation process, teacher interventions |

*Learning outcomes and task-output*

Kuhlthau (2004, p. 58) called the outcome of information seeking process learning. Limberg (2005) defined learning outcomes as the learner's understanding of the subject content. Heinström (2006a) investigated an inquiry project and linked study approaches to types of learning outcomes. Study approaches were determined by using a standardized test. Surface learners (self-)reported that they mostly learned basic information handling skills (e.g. to use a specific source) and topical facts. Strategic learners mentioned that they learned information and time management and organization skills, which helped them to be more effective. Deep learners described their topics more reflectively than surface learners, complained about the quality of sources and admitted having done more than required. (Heinström, 2006a.)

Todd (2006) studied how learners transformed information into personal knowledge. Development of knowledge was analyzed in terms of content, number and structure of relational statements, which the learners made on their topics. The major conclusion was that the statements represented development of topical knowledge in two distinctive patterns. The additive approach characterized the progressive acquisition of facts. At each task stage more descriptive statements were expressed. Integration between the statements weakened, as the amount of statements grew, until the last stage, when some organization into thematic units had taken place. The integrative approach characterized a pattern focusing on explanations and results rather than descriptions of facts. Facts were represented in coherent groups and synthesized into abstract statements. Reduced in number, the statements had a coherent structure in between them. In the last stage, personal conclusions were stated and reflected on. (Todd, 2006.)

Limberg (2005) demonstrated that the learner holding a certain conception of information seeking and use developed learning outcomes corresponding to that conception. For example, if the learner understood information seeking and use as finding the "right" answers, the learning outcome was provided in terms of the availability or non-availability of qualifying sources. Limberg suggested that there is an interactive relationship between the learner's understanding of subject content and her experiences of information seeking. (Limberg, 2005.)

IS&R research has not exploited documents produced by learners but relied mostly on interviews and surveys or settled for learners' self-assessments or teachers' assessments of learners' papers (see Kuhlthau, 2004, p. 56; Heinström, 2006a; Limberg, 2005; Todd, 2006). Kuhlthau (2004, pp. 57-58) found that the number of sources used and teachers' assessment of focus in learners' papers did not correlate, but increase in learners' confidence and teachers' assessment of focus in their papers did. (Kuhlthau, 2004, pp. 57-58.) How other document characteristics besides the number of sources, such as the structure, type, media, genre, layout and hyperlink structure, relate with learning outcomes[6] is not known.

| *Classes of variables* | *Variables and non-operationalized characteristics* |
|---|---|
| LTD: task output and learning outcomes | quality of learning outcomes, structure of knowledge, number of sources |

*3.3 Access and interaction dimensions*

*Information seeking*

Fast surfing is a pattern of information seeking characterized by a minimal investment of effort, hasty information seeking aiming to finish the search as quickly as possible, and giving up easily (Heinström, 2002, pp. 142-143, 157, 209; Heinström, 2006a, 2006b).

[6] An extensive list of researchable document characteristics is presented in Ingwersen & Järvelin (2005, pp. 340–341).

Broad scanning is characterized by a wide, gradually developing and thorough search for a quantity of documents from different types of sources. Information is discovered by accident rather than by planned searches. (Heinström, 2002, pp. 158, 236.) Deep diving is driven by the will to understand the topic. The pattern is characterized by the effort put into information seeking, focused and selective searches, and the use of a variety of information sources. (Heinström, 2002, pp. 174, 236; Heinström, 2006a, 2006b.) Heinström (2002) tested several variables to explain these patterns of information seeking. The surface study approach emerged as the major factor explaining fast surfing. Broad scanning is best explained by personality traits and disciplinary differences rather than study approaches or characteristics of the learning task. Deep diving was related to both the deep and the strategic study approaches. (Heinström, 2002, pp. 142-180.)

Limberg (1999, 2005) studied information seeking and use in terms of learners' conceptions of the subject content and their ways of understanding it. Three major categories of conceptions emerged with respect to information seeking. In category A – information seeking as fact-finding – information seeking was experienced as finding discrete facts or the right answer to a specific question. Information seeking was finished when no time or energy was left. Category B – balancing information in order to choose right – was characterized by the aim to find enough information to choose the right view to support. Learners in category C – scrutinizing and analyzing – perceived information seeking and use as means to collect enough information to understand different views on the topic thoroughly. (Limberg, 1999, 2005.)

Few researchers have investigated how different information seeking patterns or categories of conceptions of information seeking and use might manifest themselves on the web. Hultgren and Limberg (2003) discuss the issue and note that the learners in category A search for the "right" answer from a particular web document. They browse rapidly, glance through result lists for titles resembling their idea of the "right" web document, and check a few results. If the "right" document is not found, the focus of the learning task may be changed. (Hultgren and Limberg, 2003; Beheshti et al., 2005.) The more successful information seekers are likely to take advantage of the tables of contents and indices (in books) to a greater extent than those seeking for the right answer. In the

web they look for subject content in result lists and follow hyperlinks assiduously in the search for information. (Hultgren and Limberg, 2003.)

Vakkari (2000, 2001) studied how students writing a research proposal for a master's thesis sought information. The results indicated that task stages were related to the choice of search terms and tactics (in a bibliographic database). Early in the learning process, before focus formulation, learners represented their topics with a few, general search terms. The learners' cognitive structures differentiated after focus formulation, and their search terms became more numerous and specific. Search tactics were not unequivocally related to task stages, however, because some tactics reflected the learner's attempts to reduce the size of the retrieved set rather than conceptual development. (Vakkari, 2000, 2001.)

| *Research dimension* | *Variables and non-operationalized characteristics* |
|---|---|
| AID: information seeking | information seeking pattern, conception of information seeking, number of search terms, specificity of search terms, search tactics |

*Document selection*

Fast surfing is characterized by the tendency to accept the first source having any kind of relationship to the perceived task requirements. Relevance is judged mostly based on document description criteria, such as the easy availability, access, length and appearance of the document; content is considered only to the extent that information is easily digestible and confirms the existing understanding of the topic. Partially relevant sources are disregarded completely because they do not contain the whole answer looked for. Preference is shown for a certain type of documents. Relevance criteria do not develop through the task. (Heinström, 2002, pp. 142-157, 209-219; 2006a, 2006b; Hultgren and Limberg, 2003; Eskola, 2005.)

Broad scanning is characterized by critical information judgment, aiming at many tenuously related documents rather than only a few highly relevant ones, and preference for new ideas instead of old knowledge (Heinström, 2002, pp. 158-173, 220-235). Deep

diving information seeking entails profound analysis of information. This pattern of information seeking is characterized by a preference for high quality and detailed documents rather than quantity. The documents are inspected carefully, the reliability of the information questioned, the ability to inspire reflection and new thoughts is preferred, and the situation in which the document was produced is noted. Relevance criteria change during the information seeking process: documents deemed potentially useful in the first stages could in the later stages be regarded as irrelevant and be set aside. (Heinström, 2002, pp. 174-180, 236-242; 2006b; Eskola, 2005; Hultgren and Limberg, 2003.)

Learners in Limberg's (1999, 2005) category A preferred physical and intellectual ease of access, discarded biased material due to lack of facts, and preferred direct answers to research questions. The most important criterion of relevance in category B was the extent to which the information covered the topic and helped to answer research questions. Bias was accepted, as the answer from one side was chosen as the right one. Learners in category C needed information that provided different perspectives on all aspects of the topic and helped them to attain a structured view on their topic. Biased information provided a basis for analysis. (Limberg, 1999, 2005.)

Vakkari (2000, 2001) demonstrated that task stages are related to relevance assessments. As students explored topics for master's thesis proposals, they became more knowledgeable and able to make stricter relevance assessments. Consequently, fewer documents were considered relevant. The type of information sought changed from relevant information related to a general topic towards specific information related to the focused topic. (Vakkari, 2000, 2001; see Kuhlthau 2004, pp. 44-52, 81-84.)

| *Research dimension* | *Variables and non-operationalized characteristics* |
|---|---|
| AID: selection | relevance criteria, specificity of information sought |

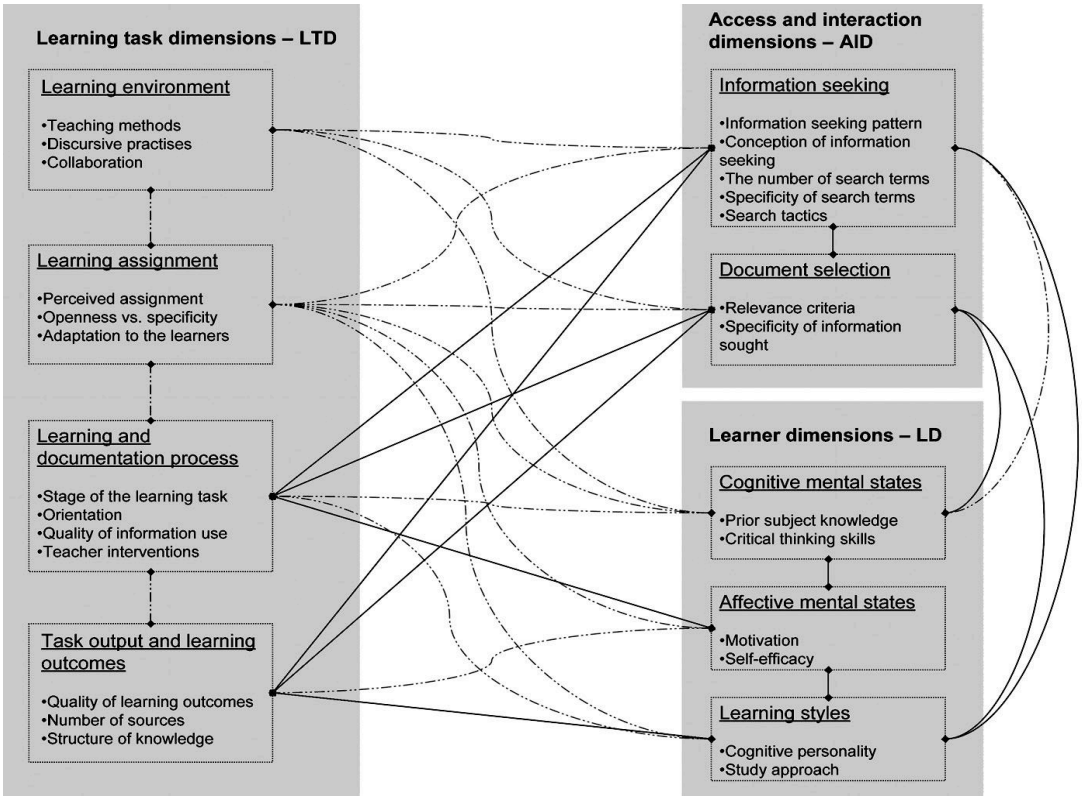
## 4 Summary and discussion

The process model (see Figure 1) and the Integrated IS&R Research Framework were utilized to organize the literature and to discuss characteristics of and relationships

between the learner, the learning task, and the access and interaction research dimensions. The results are summarized in Figure 2.

The figure presents a task-based perspective on the IS&R research related to information behavior in learning tasks. The solid lines represent relationships studied explicitly in the reviewed literature. The broken lines represent our interpretation of the literature and our proposals for the relationships to consider in further task-based research. We discuss the main findings as follows.

**Figure 2.** The summary of the research dimensions and relationships




The patterns of information seeking resemble the conceptions of information seeking even though the researchers in question adopted different perspectives (see Limberg, 2005). One might be tempted to link the patterns to the stages of the learning task, but empirical research does not support such a conclusion (Heinström, 2002, p. 239). Individual characteristics of information seeking patterns may be explained by other variables than the overall pattern they have been linked to. For example, anxiety is a common experience in the early stages of the task, but it is also a characteristic of the fast

surfer; thoroughness may characterize information seeking at the early stages of the task, but it may also be a habitual way of seeking information or a reflection of the epistemological beliefs of a discipline. (Heinström, 2002, pp. 211, 228, 231.) These findings suggest that researchers focusing on tasks should control or at least acknowledge the characteristics of the individual and the environment.

The learning process itself has received little attention. However, IS&R researchers are aware of the challenge of designing learning tasks capable of motivating typical schoolchildren, who will not commit themselves to assigned learning tasks. Excessive openness of the learning assignment is likely to impede learners' efforts to formulate a focus for their learning tasks. The formulation of a focus can be thought as a change in information behavior attributable to fundamental transformations in the way of knowing about a topic. If a focus cannot be formulated, and there is an assignment to be carried out, the learner is likely to adopt a survival strategy and remain unmotivated. The failure to formulate a focus can – given its effects – be linked to extrinsic motivation and product orientation, which are both typical especially for schoolchildren. The surface study approach, which is in part an effect of extrinsic study motivation, could be linked to product orientation as well. Thus, information behavior associated to the product orientation may be typical for the learner rather than just an effect of a temporary lack of motivation associated to the pre-focus stages of the learning task.

How the orientation towards the product or the process of learning could relate to learning outcomes, described in terms of the patterns of knowledge construction, is not explicitly discussed in the literature. However, it is perfectly conceivable that, for example, the process orientation and the integrative approach to knowledge construction are linked. Whatever the factors involved here are, the issue is important, because the literature demonstrates that the learner holding a certain conception of information seeking and use, or adopting a certain study approach, achieves corresponding learning outcomes. We conclude that many of the discussed phenomena might be closely linked or conceptually overlapping. We recommend that instead of proposing more models and terms researchers should pay more attention into integrating their research frameworks.

The reviewed literature contained little empirical research on information use – in contrast to information seeking and searching – in the documentation process, on the

characteristics of resulting learner-produced documents, and how these relate to learning outcomes. The steps involved when a mixed bag of notes on search results and documents retrieved is developed into a more or less coherent paper have not been investigated. The reviewed studies did not present information seeking and writing as convergent and simultaneous processes but rather as consecutive phases, where learners went into school libraries to make notes and then returned to their classrooms to write their research papers. The role of writing in learning and writing as a form of reflection have been studied in learning research, for example, as the use of portfolios (Lonka et al. 2001). Kavli and Mikki (2006) report on the development of web-based learning system aimed at integrating information seeking and writing.

These main findings need to be contrasted with the goals of information literacy education in schools and universities. We believe that strengthening good information behavior practices, as a sub-goal of learning tasks, is a key to information literacy (see Tuominen et al., 2005). The teacher needs to have well-established instructional tools to design and direct learning tasks to achieve this sub-goal. It is not enough that the teacher is able to recognize the symptoms of surface learning, fast surfing and orientation towards documentary output rather than learning outcomes; the teacher should be able to persuade the learner to take constructive approaches in information behavior. The ideal situation where the learner is able to concentrate on a focused aspect of the subject content should be endorsed sufficiently in real life learning situations. The task-based approach offers a promising avenue to synthesize research on learning assignments, teacher interventions, learning process, and information behavior. This paper has provided only a preliminary picture of the factors influencing the learner's information behavior in the learning task. Ideas adopted from learning research would help to develop IS&R research in this area, especially with respect to teacher interventions and the learning and documentation process.

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# Prospective history teachers' information behaviour in lesson planning

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Abstract

***Introduction.*** *Information literacy education tends to take for granted teachers' own information literacy and their ability to integrate the Internet in teaching to facilitate students' information literacy. The article reports the results of a pilot study investigating young teacher trainees' information behaviour in lesson planning.*
***Method.*** *Fourteen prospective history teachers were interviewed individually in April 2007.*
***Analysis.*** *Content analysis was conducted on transcribed interviews. Atlas.ti qualitative data analysis software was used to segment, compare and organize the data.*
***Results.*** *At the end of the training period the teacher trainees were relatively fluent and versatile information seekers who were able to cope with the challenges of lesson planning and support textbooks with information retrieved from various information sources.*
***Conclusions.*** *The results indicate that the trainees had the necessary skills to seek and use information for lesson plans. The results opened promising paths to pursue research on the trainees' information behaviour further, to address their potential as information literacy instructors.*

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## Introduction

The Internet has inspired education policies encouraging autonomous learning from authentic, real-world information sources. It has opened access to a wealth of information sources for teachers to use in support of textbooks. It has also enabled learners to seek information in breadth and depth, impossible in the traditional school environment providing local information resources only. The potential of the Internet to facilitate the novel pedagogical theories emphasizing learners' active role in knowledge construction has been acknowledged. (Alexandersson and Limberg 2005; Ambikapathi 1999; Amstutz and Whitson 1997; Branch 2003; Hinchliffe 2003; Moore 2002 and Schofield 2006.)

The developments in the ways of accessing and manipulating information have challenged teachers to address how students evaluate information on the Internet and to ensure they use information properly (Branch 2003; Childs *et al.* 2007; Hinchliffe 2003; Moore 2002). Educational policies typically have taken for granted teachers' ability to integrate the Internet into information literacy instruction and lesson planning (Amstutz and Whitson 1997; Hinchliffe 2003; Moore 2002). Researchers emphasizing the fundamental change of the information environment argue that teachers have not adequately responded to or even fully grasped the meaning of the transformation of the information environment for education. Practicing teachers have tended to be more comfortable in using the old technologies they grew up with instead of the new ones and have failed to utilize the Internet to its full potential in their teaching. (Alexandersson and Limberg 2005; Amstutz and Whitson 1997; Childs *et al.* 2007; Lankshear and Knobel 2003; Moore 2002 and Schofield 2006.)

Limberg *et al.* (2002) point out that teachers tend to regard the Internet as a textbook, which students use to find the right answers to teachers' questions instead of comparing sources of varying quality and taking different perspectives on issues. Many teachers underestimate the uncertainties involved in information seeking, assign learning tasks that are too demanding, lack definite strategies in information seeking instruction and assume that information literacy is learned by doing without explicit instruction (Amstutz and Whitson 1997; Limberg *et al.* 2002; Moore 2002). There is even some evidence indicating that teachers demonstrate much of the same impoverished information behaviour and struggle with the same issues as their students do (Moore 2002).

Novice teachers enter the profession with preconceptions or experiences of teaching, learning and information seeking, which influence their understanding of information literacy education (Bruce *et al.* 2006; John 1994; van der Valk and Broekman 1999). The novices are yet to develop professional practices (John 1991; Madden *et al.* 2005), but there is the promise that once exposed to the Internet and the novel pedagogical theories in training they would be more likely to show the 'insider mindset' with regards to the Internet than their predecessors (see Lankshear and Knobel 2003: 32-33, 59-64; Madden *et al.* 2005). The new generation of teacher trainees might have grown up in the new information environment, but little research is available on their practices in information seeking and use, the clarity of their conceptions in these issues, and their ability to reflect on their own information behaviour (see Branch 2003).

The overall goal of our project is (1) to develop digital portfolios and mobile devices as means to foster teacher trainees' reflective learning and (2), to study teacher trainees' understanding of their information behaviour in lesson planning as an indicator of their proficiency as information literacy instructors. This paper focuses on the second sub-goal. We co-operate with the Unit for Pedagogical Studies in Subject Teacher Education at the University of Tampere. Their basic educational idea is that teachers' professional skills develop from experience, in reflection with novel pedagogical theories, into didactic theories applicable in practice. In the academic year of 2006-2007 digital portfolios and mobile devices were introduced as facilitators of the teacher trainees' reflective learning activities and to mediate dialogue between the trainees. Each trainee planned and delivered training classes under the supervision of teacher educators and a tutoring teacher. Lesson planning in subject teacher education offered a chance to address teacher trainees' information behaviour in a relevant and authentic context.

This paper reports the findings of the pilot stage of the project. The goal was to elaborate lesson planning as a task context of the teacher trainees' information behaviour and to develop research questions, data collection and analysis methods for the main study. We concentrated on the following research tasks in the pilot.

- How do teacher trainees seek and use information for lesson plans?
- What do teacher trainees learn about seeking and using information for lesson plans?

The paper begins with a review of previous research conducted on lesson planning and teacher trainees' information behaviour. Then, we outline a conceptual framework for the analysis of teacher trainees' information behaviour in lesson planning, specify the research questions and elaborate the data collection and analysis methods. Then, we describe the main results of the pilot study. And finally, we discuss the results to develop a basis for further research.

## Related research

Research on lesson planning shows that teachers plan lessons (in advance) to cope with time constraints, prioritize subject content, assess learning outcomes, and anticipate classroom events. Lesson plans are written guides with varying degree of structure and detail. Lesson planning involves teachers in interpreting and transforming a significant range of information to specify learning exercises, schedules, teaching and learning resources, means to control the class, and learning objectives. A typical exercise requires students to complete a worksheet or to prepare a presentation. The Internet is sometimes used in exercises to improve students' interest and motivation, promote active learning and freedom of choice, allow students to work more independently in interaction with content (e.g., receive feedback from Websites), and provide current, first-hand materials with greater level of detail than textbooks. Researchers have found that teacher trainees' lesson planning practices develop through their training period as a result of influences from subject content, knowledge of pupils' abilities and needs, classroom experiences, personality, method tutors and mentors in schools, and schools' definitions of the teacher's role. (Childs *et al.* 2007; John 1991, 1994; Jones and Smith 1997; Macklin 2001; van der Valk and Broekman 1999 and Uusikylä and Atjonen 2005: 62, 66, 71-81, 118-128.)

Madden *et al.* (2005) surveyed practicing teachers' views of the Internet as an educational resource. Most teachers found the Internet a valuable source of information that could make an important contribution to teaching if it were only used to its full potential. Particularly young teachers, who had more experience of using the Internet, were confident in their ability to use the Internet and found search services easy to use. The teachers who perceived information overload due to the number of sites that search engines offered to them had typically the least experience of using the Internet. Older teachers with less experience in using the Internet were more confident in students' ability to search the Internet without being overwhelmed by the number of sites retrieved. (Madden *et al.* 2005.)

Branch (2003) studied how a resource-based teaching course influenced teacher trainees' understandings of information literacy. Early in the course the teacher trainees considered finding, locating and acquiring information as aspects of information literacy. Towards the end of the course terms indicating processing, solving and organization of information had entered in the trainees'

definitions of information literacy. Few trainees considered information use, assessing the credibility of information, or understanding differences in information sources as aspects of information literacy. Some trainees reported that they needed to be information literate as teachers to be able to find information to supply textbooks and choose the right method to teach a particular subject. However, the trainees gave few indications regarding helping their students to be information literate. The trainees perceived learning during the course to identify information needs and to think critically which resources would meet their needs the best, and to locate, access and evaluate information found on the Internet. Branch concludes that the teacher trainee education programme seemed to teach information literacy for the trainees, but failed to provide them with the skills of how to teach information literacy to their students. (Branch 2003.)

## Core concepts and research methods

Information behaviour is commonly used as an umbrella concept for the broad range of information related human actions such as seeking and using (Wilson 1999). Marchionini (1995) defines information seeking as the overall acquisition of information through various information channels and information searching as the use of a specific channel providing the access to information sources. Byström and Järvelin (1995) distinguish between the information channel, which guides users to information sources, and the information source, which contains the information. So, based on the definition, the Web, a library and a person are channels; an Adobe Acrobat (.pdf) file, a Web page, a book, a newspaper, and a person offering a straight answer are (types of) sources.

The information seeker's perception of the quality of the relationship between an information problem and an information source is relevance. A broad body of literature representing wide variation in research methods, user groups and information environments attests that the range of criteria applied in relevance assessments is finite. Differences in the criteria across studies may reflect information seekers' responses to situational influences such as task requirements, the information environment, and the information problem. (Barry and Schamber 1998.)

Researchers have outlined the dimensions or types of information use in various ways. Kari (2007) emphasizes the distinction between (1) using (i.e., interacting with) information sources, (2) making sense of retrieved information (to become informed), and (3) the ways in which gained knowledge is applied in action (after it has been made sense of). It is also essential to consider both mental and physical dimensions of information use, which are manifested in decision making or problem solving with information (i.e., thinking) and informing others (i.e., communicating), even if one dimension can be more prevalent. (Kari 2007.) Alexandersson and Limberg (2003) have proposed a typology (1) transporting (i.e., copying and pasting), (2) transforming (i.e., paraphrasing the information source) and (3) reformulating (i.e., completely rewriting the information source in one's own words), which elaborates the quality of information use with respect to information sources.

The two research tasks presented earlier were elaborated as the following research questions.

1. Which information channels and sources do teacher trainees access and utilize when seeking information for lesson plans?
2. What criteria do teacher trainees apply when selecting information for use in lesson planning?
3. What patterns can be identified in teacher trainees' information seeking in lesson planning?
4. For what purposes do teacher trainees use information in lesson planning?
5. What do teacher trainees learn about seeking and using information for lesson plans?

The research questions were transformed into an interview guide, which granted the researcher the freedom to rephrase questions if requested and the interviewees to interpret the questions in their own way. A teacher educator co-operating with the research project was consulted and his group of fourteen prospective history teachers, both male and female, was recruited for individual interviews at the end of their training period. The interviews were carried out in April 16-27th, 2007 and resulted in approximately six hours of audio data. The data were transcribed word-for-word, although we did not focus on linguistic or discursive features. The quotations presented are direct translations from spoken Finnish.

The aim of the analysis was not to track individual differences but to describe the trainees' recollections about seeking and using information for lesson plans. Atlas.ti qualitative data analysis software was used to segment the data into statements expressing relevant and discrete ideas or conceptions, and then, to compare and to organize the statements into groups corresponding to the research questions. After this, a summary of the statements in each group was written. To reflect the relatively unstructured nature of the interviews the statements are quantified only loosely in the text.

## Results

### Information channels, sources, and selection criteria

The teacher trainees accessed information through a wide array of channels including the Web, libraries, or on a few occasions, through mediators such as supervisors, colleagues or tutors. The Web

was used either directly from the browser's address field, from a search service (e.g., Google), or on a few occasions, from a directory service. The university and city libraries were accessed either on the spot or from online bibliographic databases. The schools' and the trainees' own collections (i.e., bookshelves) could function as information channels albeit only in the trivial roles of providing access to textbooks.

The information sources used by the trainees comprised printed and electronic documents: textbooks, books, magazines, newspapers, compact discs; Web sites, Adobe Acrobat files (.pdf), images and videos. The trainees searched images mainly through Google (image search). Wikipedia was a source that raised a great deal of spontaneous reflection among the interviewees. On one hand, many interviewees acknowledged using it, but, on the other hand, some seemed to question or even belittle its quality as an information source.

The teacher trainees' most often mentioned criteria for selecting information were topicality and (perceived) authority. The curriculum, preceding and following lessons framed topicality as the selection criterion. Impartiality (or 'objectivity') was the criteria mentioned most frequently with respect to Web sources. Information was perceived as being more reliable if it was reiterated in different sources:

> *If the same thing is being said on twenty Web sites, in the same way, it's quite likely to hold true, and I no longer care about it if I'm having a class for the upper level of comprehensive school... then I don't bother going to university library. But if, for example, information in the Net is in conflict, then it had to be verified from somewhere else. [R11]*

The illustration exemplifies also how the effort teacher trainees put into information seeking could vary with regards to the class level.

Some trainees tended to think how the information might be used while selecting sources. They estimated the amount of work needed to adapt information to use in the lesson plan and considered its suitability with their students in mind. Other criteria, appearing infrequently in the data, were the novelty of information, the diversity of viewpoints offered, the quality of image files, and the equipment available in classroom.

## Information seeking patterns

The teacher trainees stated that they often knew only a little in advance about the topics they were assigned to teach, because of the breadth of history and social studies curricula. The trainees' subject knowledge greatly influenced their information behaviour:

> *If I was really familiar with a topic... then you knew what to search and what you wanted to talk through in that lesson, but if the topic was really, really peculiar, er then... seeking information was in a way a part of that you were learning that topic by yourself. And once you got to search more into it, er [the topic] maybe changed, that things that you had thought to use in it were left out and other things were taken in. [R12]*

Many trainees described a similar variation in the specificity of search goals. One, for example, had searched the Web for the number of deceased Finns in the Continuation War (between Finland and the USSR, 1941-1944) and, in contrast, information on the (European) Explorers to decide to which ones to focus on. Another trainee illustrated how the subject could influence information seeking:

> *For example high school law education, well er... one knows at once where to search for laws, from Finlex's pages... a share of information is such, that in a way, you know in advance where to find that information, and then always, usually in the case of history... it's just a lottery, that 'let's hit this with the period of oppression and wish for some really good stuff to come up that I can use'. [R2]*

Most trainees read the textbook first to get acquainted with the topic. One trainee explained that he wrote lists of essential themes based on the textbook, compared different series of authorized textbooks, and then modified the list to reflect themes recurrently occurring in the literature. Based on the reading of the textbooks the trainees made the decision to search for more information or get on with the information they already had. A trainee illustrated how reading textbooks constituted the framework for information searching on the Web:

> *I usually went to Google and then put [there] some search words that I knew of - or had found with the help of that book's chapter - like, those main issues that should be searched [on the topic]. [R4]*

The Web would be used to explore the topic if, for example, a topic was only briefly discussed in textbooks, but this was found to be laborious. One trainee complained of spending five hours browsing the Web to familiarize herself with labour market organizations. The trainees, when they were aware of useful resources, accessed them straight from browsers' address fields, but simple *googling* prevailed when the nature of the problem preferred it.

## Information use

The teacher trainees used retrieved information in lesson plans to complement textbooks, exemplify, illustrate, maintain interest, or raise discussion. They distributed handouts or photocopies to students or presented images with a projector or a document camera. The trainees often assigned learning activities as a substitute for giving lectures to keep students interested in the subject content. So, as a trainee put it, after acquainting herself with the topic, she started thinking what kind of activities she would use. One trainee told of seeking ready-made exercises or information that could be used in making exercises, at this point.

The trainees thought carefully about how to present information to students:

> *It is pretty challenging after all, that if you think about transforming information meant to adults for seventh graders. And there is, that even if the information was theirs to chew up, then what is the way I present it to them? [R6]*

One trainee compared different textbooks for cues of how to present issues in a way understandable by students. A trainee explained how he would plan to present information:

> *I usually tried to start from a question, which relates to a detail in a picture. Sometimes [I started] from that OK, anyone happens to know whom does the picture portray? But usually it started from, or the purpose was that it would have started from details, that what is the difference between these two characters... And then you in a way guide the students to see meaningful elements in pictures such as these, give meanings to them, suggest and guide them into that interpretation. [R11]*

A trainee explained when asked, what exactly she did with information when using it:

> *Usually I simplify it... or mix information from a number of sources or transform that information into exercises, but... if I find an article or else from the Net - well sometimes I have shown straight... that articles found from newspapers of course straight - but usually all information from the Net has to be processed, that seldom you can just print let's say a five page article, that 'let's read from this', so you must do something for it. [R2]*

When processing information the trainees either chose only the parts of documents they perceived their students would comprehend, simplified the vocabulary used in the originals, reduced and synthesized information. Only images were, or could be, used without processing the originals.

## Perceived learning outcomes

Many trainees perceived difficulties in assessing information sources and often lost their way when searching for information on the Web. The trainees' reflections on learning outcomes were to a great extent characterized by experiences of coping with information overload. Some trainees just grew to use textbooks when familiarizing themselves with the general topic and avoided using the Web except for specific searches. The trainees perceived they became better at filtering information. Some noticed that they did not have to master the topic thoroughly to be able to teach it, because they could estimate what would be enough, based on the students' age and comprehension and thus save themselves the extra work. A trainee explained that she had learned to make it clear to herself what the topic is about and only then sought the information she perceived she would need.

Finding the appropriate means to present information in the limited time frame and in a way maintaining students' interest was another major issue characterizing the trainees' reflections on learning outcomes. Many trainees found exercises to be a viable alternative to lecturing. One trainee stressed the importance of presenting information in an organized manner:

> *No one learns from a list of trivia, but if [the content] is organized thematically, chronologically or otherwise, one might remember something about it. [R11]*

Another explained his conception of historical knowledge:

> *Teaching history is largely about teaching facts... there are certain historical facts, that must be presented to students in proper proportions or the students themselves [have to] work on something wherein [they become familiarized with these facts]... But of course information searching, if you think about it, should be taught to students, so it is important to be aware of how your own information searching or how you should search... so that the students too will not go to Google first. [R5]*

This trainee was the only one to bring up teaching information seeking or searching in subject teaching.

# Conclusion and discussion

The pilot study gave us an overall picture of teacher trainees' information behaviour in lesson planning. Most of the trainees were fluent users of Web resources and can be called insiders in this respect. The teacher trainees accessed information through a diverse set of channels and utilized

various types of sources. They applied various information seeking strategies based on their subject knowledge and the purposes for which they intended to use information. The trainees learned ways of coping with information overload. They were able to locate and retrieve relevant information from the Internet and use information in different media in support of textbooks. The trainees were concerned about the quality of information retrieved from the Internet. They selected and presented information with their students' age and comprehension in mind. These results indicate that finding relevant information was not a major problem for the trainees.

The issues of interest emerging from the data are how teacher trainees

- coped with information overload by filtering and avoiding information;
- determined when they had done enough (information seeking);
- presented information in a way that their students could comprehend;
- perceived the usability of information on the basis of their students' comprehension;
- used their assessment of the usability of information as a selection criterion during information seeking (indicating why seemingly relevant information sources are not selected for use); and
- do not seem to adopt teaching information seeking skills as a part of their role as subject teachers.

The findings suggest that the prospective history teachers' ways of seeking and using information are in line with the standards defined in information literacy initiatives such as the Australian and New Zealand Information Literacy Framework and the Information Literacy Competency Standards for Higher Education. The trainees' methods may not have been the most efficient but they were able to get the work done. We are aware that history majors, extensively trained in independent information seeking through traditional information channels (e.g., libraries and archives) and the Internet, might not be representative of teacher trainees in general. For the main study, we organized another group comprising trainees in subjects other than history to collect a more diverse sample.

Our findings relate to those of Branch (2003) as similar issues seemed to characterize teacher trainees' information behaviour in both studies. We also find that the studied teacher education programmes do not encourage teacher trainees to instruct students in information seeking and use. In both studies few teacher trainees gave indications of being aware of the importance of helping their students to become information literate; however, we refrain from making strong conclusions at this point since the pilot study was not designed to assess the teacher trainees' information literacy. It is debatable, of course, whether the history teacher trainees possessed the high order thinking skills, that are set in the information literacy standards as a requirement for reflective information behaviour. It is also possible that the interviews did not give the trainees the necessary trigger or the chance to reflect on their views on (teaching) information literacy. Neither were information seeking and use introduced as specific goals in the portfolio activities nor in teacher education in general. Hence, it is possible that, while having the skills associated with information literate behaviour, the trainees might not have been prepared to discuss these issues.

We identified two major shortcomings in the way data collectection was implemented in this study. First, the interview questions involved abstractions, which the researcher had to concretize for the interviewees. As the questions were not (re)phrased in identical manner, the interviews became less formal than initially planned. Second, the interviews took place several weeks after the training classes had taken place, because the project was launched too late in the academic year. Hence, the trainees were not able to recall their lesson planning efforts in the detail assumed when the interview guide was designed. When collecting data for the main study we know better what to expect from the trainees and will organize the interviews as soon as possible after the classes are held.

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## Appendix: the interview guide

1. Describe an example of a lesson planning related problem solving or decision making situation, in which you recognized the need to and succeeded or failed to find information.
    - From where did you seek information in this situation?
    - How did you seek information in this situation?
    - What kind of conception did you have of the information you needed in this situation?
    - By what criteria did you assess the usability of the sources you found?
    - How and for which purpose you used information in this situation?
    - To what extent you were able to use information directly, or to what extent did you have to process it?
    - Which of the information sources used in this situation were used in the final lesson plan?
2. Did you use all the information gathered for the lesson plan? If not, which sources did you not use?
3. Were you able to support your original ideas with the retrieved information or did you have to modify your ideas according to the information you were able to find?
4. What do you think you have learned about information seeking and use in lesson planning?

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# Teacher trainees' information acquisition in lesson planning

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Abstract

***Introduction.*** *Few studies have addressed teacher trainees' information acquisition in the context of a task. The paper reports findings from an empirical study on teacher trainees' use of information (seeking) channels and sources, and their modes of information acquisition in lesson planning.*
***Method.*** *Semi-structured (retrospectively held) individual interviews and supporting classroom observations were conducted.*
***Analysis.*** *Inductive thematic analysis was applied to the transcribed interviews.*
***Findings.*** *The trainees used various information channels for a single lesson plan, mainly their personal collections and the Web. The information sources acquired comprised documentary and interpersonal sources, various media and contents. Their information acquisition encompasses a continuum of modes beginning with purposeful and goal-orientated, and ending up with accidental and passive modes of information acquisition.*
***Conclusions.*** *Trainees' information acquisition for lesson plans cannot be described only in terms of their present activities or goal-orientated information seeking behaviour. The use of personal collections of information sources, gathered in the past in anticipation of future lessons, constitutes an essential characteristic of their information acquisition. Trainees' modes of information acquisition reflect continuity across work tasks, which calls for capturing across task perspectives in information seeking models.*

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## Introduction

Teachers' information acquisition has received limited attention in information seeking and retrieval studies. Particularly lacking is research that scrutinises teachers' tasks. A fundamental teacher's task is lesson planning. Teachers plan lessons to transform a curriculum or a syllabus, institutional expectations and their educational conceptions into practical guidelines for the classroom (John 1991, 1994, 2006; Jones and Smith 1997). Lesson planning is a core issue in teacher training because of the challenge it poses to beginning teachers.

The goal of the present study is to describe teacher trainees' information (seeking) channels and sources and their ways of acquiring information in lesson planning. The task is used as a framework for analysing access to information sources. According to Byström and Hansen (2005), and Vakkari (2001, 2003) the premises of task-based information seeking and retrieval studies are that tasks trigger (more or less) purposeful information seeking to the accomplishment of a goal, and that information seeking is dependent on and interesting only in connection to the primary goal of the task. A task is a sequence of actions focusing on a particular item of work involving a purpose, a practical goal (i.e., the result or outcome of the task), implementation methods and requirements. Task-based research typically takes a single task into focus, explaining changes in the task performer's activities in terms of the stage of the task.

The paper reports selected findings from a research project scrutinising teacher trainees' (hereafter, simply, 'trainees') information behaviour in lesson planning. The project was carried out in co-operation with the

Unit for Pedagogical Studies in Subject Teacher Education, at the University of Tampere, Finland, in the academic year of 2007–2008. The pilot study (Tanni *et al.* 2008) provided preliminary results concerning the teacher trainees' use of information channels and sources, and other characteristics of their information seeking behaviour.

The paper is organised as follows. The first section lays down the conceptual framework: information channels, sources, information acquisition and the key characteristics of the task. Research questions are presented at the end of the section. The second section elaborates the case, data collection and analysis methods. The third and the fourth sections, respectively, present and discuss the findings. The final section presents the conclusions.

## Core concepts and related research

Information sources are physical entities in a variety of media providing data or signs, which may become information when perceived (Ingwersen and Järvelin 2005: 386). Information sources are therefore not synonymous with information contents. According to Byström (1999: 31–32), the information seeking channel is the intermediary, which guides the information seeker to the source. The information channels are enabled by but not synonymous with various technologies. Information channels, like sources, may be informal (i.e., interpersonal) or formal (i.e., documentary) and, like sources, exclude the information seeker. There is no absolute difference between sources and channels: particularly interpersonal information channels may turn into sources and vice versa. (Byström 1999: 31–32; Leckie *et al.* 1996.) Direct observation is a unique information channel, for it does not provide access to information sources as representations of authors' interpretations of the world but sensory data only (see Serola 2009: 70; Ingwersen and Järvelin 2005: 47–54).

Byström and Hansen (2005: 1055) elaborate the distinction between the two concepts by arguing that '*[i]nformation channels are used to become aware of and locate appropriate information sources that contain, or are expected to contain, the actual information sought for*'. They also conceptualise information seeking as a type of sub-task performed in support of the task proper, emphasising that information seeking is meaningful only in relation to the latter. However, information acquisition may and typically does involve referrential information that is relevant only to the performance of a sub-task and not directly to the task proper. It is therefore useful to discern between information channels and sources on the basis of task levels.

Sonnenwald (1999) has argued that human information behaviour takes place in a context of a variety of related situations, wherein an *information horizon* of information resources is available: social networks (e.g., colleagues, experts, librarians and other information brokers), documents (e.g., books, Websites and broadcast media), observation in the world and information retrieval tools. Leckie *et al.* (1996) have argued similarly that professionals' *awareness of information* and their perceptions about the process of information seeking determine their choice of information channels and sources. Many empirical studies have concluded that professionals prefer to choose information channels and consult sources they are familiar with (Byström and Hansen 2005; Ellis and Haugan 1997; Leckie *et al.* 1996).

McKenzie (2003) has presented an empirically derived two-dimensional model capturing a whole spectrum of *information practices* beyond the purposeful activity invoked by the term information seeking. The first dimension discerns between four modes of information practices: *active seeking* for a specific goal, *active scanning* of a subject without a specific concern, *non-directed monitoring* with no intent other than to become generally informed, and *by proxy* when informed by others on their initiative. The second dimension discerns between the two stages of *making connections* and *interacting with sources*; for example, between seeking contact with or being contacted by an information source and asking questions from or

being told by an information source.

Ellis and Haugan (1997) have presented an empirically derived model based on behavioural *patterns* in information seeking. *Surveying* is an aim for an initial overview of the topic, often beginning with an established *starting point*. Surveying known people or documents from earlier projects is called *consulting*. Following referential links between information sources by starting from known sources is called *chaining*. A sub-aspect of chaining is *verifying* specific pieces of knowledge. *Monitoring* is an aim to maintain awareness of developments in a field by regularly following particular known information sources. Both surveying and monitoring can manifest themselves as behaviour such as *browsing*. (Ellis and Haugan 1997.) The patterns of surveying and monitoring are open for reading as a goal (to gain an overview and to stay up to date) and browsing and chaining, for example, as the behavioural means to achieve the ends.

Kuhlthau (2004) has presented an influential *information search process* model explaining changes in information seeking behaviour in terms of task-performers' mental states. Vakkari (2001: 58) has elaborated the model and confirmed that information seeking depends 'systematically on the stage of the task performance process and the mental model of the searcher'. Task-based research, using Kuhlthau's model as the framework, takes a single present task performance process and an individual's cognition as the points of departure.

Challenging models based on Kuhlthau's, the literature attests for variation in goal-orientation, problem-specificity or direction in information acquisition. It is possible to discover information even when not actively seeking information. Serendipitous or accidental forms of information discovery can be placed on a continuum where they oppose the most purposeful, goal-orientated or -directed modes of information acquisition (Erdelez 1997; Foster and Ford 2003; McKenzie 2003).

In the present paper, the term information *acquisition* is preferred, for it does not imply activity in the way the term *seeking* does (see Erdelez 1997; McKenzie 2003). The term *mode* is used of the way or the manner in which information is acquired. The *modes of information acquisition* are abstractions of information behaviour. They should not be understood as conscious information seeking strategies, but more of features or characteristics that such strategies might have. The modes are not about patterns either, because patterns imply consecutive steps of action, which are not implied in the present paper.

Some modes of information acquisition, accidental information encountering and monitoring particularly, presume a conception of a *time horizon* extending beyond present activities: past information needs coming to mind and information perceived as being valuable for anticipated uses. Social contexts may affect the ways in which individuals perceive time horizons encouraging the adoption of either narrower or broader views. The anticipation of future tasks is a reason and a requirement for keeping personal collections of information sources at hand. A degree of contextual and situational continuity is required to be able to anticipate future needs for information and exploit the personal collection. (Bruce 2005; Byström and Hansen 2005; Erdelez 1997; Foster and Ford 2003; Leckie *et al.* 1996; Savolainen 2006; see Sonnenwald 1999 for more about context and situation.)

In teacher training lesson planning is both a learning task and an authentic work task at a real school (see Kim and Roth 2011). In a typical training scenario, the mentoring teacher in the training school assigns a topic, but leaves the teacher trainee with a degree of freedom, within curricular restrictions, to carry out the task. Teacher training institutions and school-based mentors might offer instructional templates for teacher trainees, laying out the structural elements of the task in various levels of detail and rigidity. Lessons are planned consecutively and in parallel over the training period. Both short and long term planning takes place (Jones and Smith 1997; Perrault 2007). Trainees consider a complexity of factors in lesson planning: the

curriculum, subject content, learning assignments and activities, classroom control, pupils' and students' age, abilities and learning, and suitable resources (John 1991, 1994, 2006; Jones and Smith 1997). As novices, trainees need contextual information about pupils' and students' abilities, individual needs and classroom behaviour, which is typically available only over interpersonal information channels (see John 1991, 1994; Kim and Roth 2011). With experience, trainees learn means to cope with information overload and seek information efficiently for lessons plans (Tanni *et al.* 2008). The context and the situation therefore add predictability and stability to trainees' perspective on the task.

Few studies have addressed trainees' information acquisition in lesson planning. Summers *et al.* (1983) surveyed teachers' use of information sources in general. Small *et al.* (1998) surveyed teachers' use of information sources in instructional planning, which covers both daily lesson planning and long-term unit planning. Perrault (2007) surveyed and interviewed teachers about their use of *online resources* (i.e., Internet-based services) in instructional planning. Merchant and Hepworth (2002) interviewed teachers about their use of information sources in lesson planning. The studies give a general picture of the variety of information channels and sources used by teachers in general or in instructional planning. The studies do not discern between information channels and sources, preferring the latter term, or between referential information and actual information used in the task proper. It is also noteworthy that the surveys questioned teachers on their use of given (i.e., pre-defined) information channels and sources, perhaps missing some options.

The literature gives some ideas on the ways teachers acquire information for lesson plans. Small *et al.* (1998) suggest that teachers, by using a variety of information sources in instructional planning, pick *nuggets* of information from several sources over evolving searches. Merchant and Hepworth (2002) and Perrault (2007) point out that teachers seek information for a variety of purposes, which suggests variation in the ways information is sought. The pilot study (Tanni *et al.* 2008) demonstrated that teacher trainees, facing the topical breadth of history and social sciences curricula, expressed substantial variation in the specificity of search goals, depending on how much they knew about the topic and useful information sources in advance. The trainees explained between returning to information sources on the basis of past experiences and exploring broad topics while still learning about them.

The paper will address the issues brought up in the literature review, mainly the trainees' information horizons or awareness of information and their ways of acquiring information in the context of lesson planning. The following research questions are addressed in the present study:

1. What information channels and sources do trainees use in lesson planning?
2. What are trainees' modes of information acquisition in lesson planning?

Both of these questions are addressed by using the task-based viewpoint (a) in the analysis of information channels and sources and (b) to characterise lesson planning as a task with the trainees' modes of information acquisition.

## Data, sampling and analysis methods

A total of twenty-three subject teacher trainees, seventeen women and six men, most in their late twenties or early thirties, were recruited in the academic year of 2007–2008, with the help of two teacher educators. The participants had majored – or were in the process of majoring – in history, social sciences, psychology and philosophy.

In Finland, subject teachers teach in basic education (grades 7–9), general upper secondary education, in liberal adult education institutions or as teachers of core subjects in vocational institutions. In the teacher's pedagogical studies each trainee plans and delivers

approximately thirty training lessons under the supervision of a mentoring teacher (hereafter, simply 'mentor') at a school. The mentor and the trainee meet and agree on a general topic. The mentor typically does not give strict teaching assignments with explicit requirements for the training lessons. Instead, s/he assigns a topic leaving the trainees the freedom to plan the lessons according to their own discretion: outline a schedule for the lesson, select appropriate teaching methods, acquire information resources, and plan exercises (if any), but not necessarily in this order. Teacher educators at the university give guidance and practical instructions. The mentors have a variety of practices of their own, but they do often request a schedule of the lesson in advance, observe the training lessons on the spot and give feedback.

Individual interviews were the primary data collection method. Many respondents were unwilling to be interviewed or observed at their homes or just preferred to be interviewed at their training schools, which ruled out interviews and direct observations of information behaviour during lesson planning activities. The retrospective interviews posed limits on the kind of data that could be collected on lesson planning as a process. A semi-structured interview guide (see Appendix) was used, but the questions were rephrased if clarification was needed. The researcher attended a single training lesson for each trainee and observed what information resources the trainee presented to the class. After the lesson, the researcher interviewed the trainee concerning the lesson. The observations were exploited to particularise interview questions, to provide common ground for discussion and to ensure that all information resources used in the class were dealt with. If the parties had not been able to agree on the schedule, the interviewee was prompted to choose a lesson in his or her best memory for the interview; practically the latest lesson. About two-thirds of the lessons were observed. The first interview was held in December 2007 and the last in April 2008. The interviews were recorded with a laptop computer and resulted in approximately seven-and-a-half hours of audio data. The median length of a single interview was approximately seventeen minutes and the average twenty minutes. The recordings were transcribed by a professional service.

The transcripts in Finnish were analysed thematically, using the HyperResearch software package. Thematic analysis is a process of encoding (i.e., classifying or categorising) qualitative information with explicit codes. A theme, at minimum, is an observation and a description of a pattern on the manifest level of data and, at maximum, an interpretation and an explanation of the pattern on the latent level (Boyatzis 1998: 4, 16–17). A code captures the essence of thematic observations as a label and a description, thereby providing a link between data and the researcher’s ideas about the data (Boyatzis 1998: 11, 31–32, 48–49). Each code covers ‘the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon’ (Boyatzis 1998: 63–65). In the present study, codes were assigned to units of data between a few words to a few sentences. The unit of analysis (or the case in HyperResearch), the entity being analysed (Boyatzis 1998: 62–63) and encoded, was the individual teacher trainee, represented by the corresponding interview transcript.

The code development followed the hybrid approach described by Boyatzis (1998: 51–53): previous research was consulted for ideas, but codes were developed inductively from the data instead of being derived from a theory or adopted from a previous study. The following ideas proved essential to make sense of the data. The task-based view helped to discern between referential information and information directly applicable to the task. Therefore reading lists and intermediaries making recommendations for literature, for example, were not considered as information channels or sources in the findings. It also proved very helpful to follow McKenzie (2003) and discern between the stages of (1) seeking or making connections with, or being contacted by, information sources directly or by referral, and (2) acting, or being acted on, in established connections with information sources. The notion proved essential to analyse situations where getting access

to information sources was so trivial that the respondents did not elaborate on it: these included, for example, accounts on monitoring a daily newspaper at home or consulting the mentoring teacher at the school.

The principle of constant comparisons (see Lincoln and Guba 1985: 339–344) was followed through the analysis. The data was read through with the research questions in mind and an initial set of themes was produced based on perceived (dis)similarities in the data. The data was read through again case-by-case and coded for the presence of the emerging themes. The themes were then retrieved code-by-code and checked for consistency within each theme and for differences across the themes. Reading within a theme emphasised the differences in the theme; reading across the themes emphasised the similarities in each theme. The codes were written to ensure the maximum of differentiation in the data: a pattern of data was coded only as one of the several related themes. The codes were refined in further constant comparisons between the thematic units of data and corresponding code descriptions. The descriptions were reformulated and themes were split or new ones added. The codes, thus, gradually tested against the data, became more discriminating and consistent. The process was concluded when the properties of the revised codes were crystallised and stabilised. Anomalies are discussed in the next section.

## Findings

The findings are presented as tables and elaborated in the text. The scores represent the number of respondents (i.e., units of analysis) with the corresponding theme coded present at least once. Therefore, the maximum number of respondents (i.e., n) associated with the theme is twenty-three. The codes were considered either being present or absent in the unit of analysis, and the frequencies of occurrences were not considered. The individual respondents are identified in the text as the letter C (as in case) and a pseudo-random number when quoted.

### Trainees' use of information channels and information sources

Table 1 summarises the information channels and the associated sources used by the trainees. The information channels are organised by the number of associated respondents and discussed accordingly. The information sources are discussed along with the first channel they were associated. Information sources accessed over the task were coded according to the information channel used at the time and not according to the channel used originally. Websites, online library catalogues or people acting as intermediaries offering referential information, were not considered as information sources under the criterion that an information source should directly support the lesson planning task.

| Information channels | n | % | Information sources | n | % |
|---|---|---|---|---|---|
| Personal collection | 21 | 91 | Textbooks | 15 | 65 |
| | | | Books (non-fiction) | 10 | 43 |
| | | | Personal files | 7 | 30 |
| | | | Periodicals | 3 | 13 |
| | | | Educational materials | 3 | 13 |
| | | | Notes | 3 | 13 |
| | | | Personal photographs | 2 | 9 |
| Web | 21 | 91 | Websites | 15 | 65 |
| | | | Unspecified Web | 13 | 57 |
| Interpersonal resources | 10 | 43 | Mentoring teacher | 6 | 26 |
| | | | People | 3 | 13 |
| | | | Textbooks | 1 | 4 |
| | | | Books (non-fiction) | 1 | 4 |
| | | | Videos (recording) | 1 | 4 |
| Libraries | 10 | 43 | Books (non-fiction) | 10 | 43 |
| Observation | | | | 6 | 26 |
| Exhibitions | 2 | 9 | Unknown | 2 | 9 |
| Unknown | 2 | 9 | Books (non-fiction) | 1 | 4 |
| | | | Classic novels | 1 | 4 |

**Table 1: Information channels and sources**

**Personal collection** is an information channel providing access to information sources employed by the trainees when engaging in the task. The personal collection retains information sources stored (e.g.,

saved, bought or loaned) earlier. Unconditional access to the information sources is a characteristic: a familiar book in the library or a Website might become inaccessible for reasons beyond the trainee's personal influence. The personal collection covers both the printed information objects such as books and the digital documents saved on the trainees' personal computers. The personal collection provided access to various different types of information sources.

**Textbooks** are those deployed by the school, textbooks from alternative book series, and the trainees' old textbooks from high school. In other words, books written for the purpose of teaching pupils of a particular grade. **Books** comprise nonfictional and academic monographs but excludes textbooks and fiction, which came up in the data rarely. Non-fiction comprised, for example, general works on history of philosophy, philosophical dictionaries, theological literature, art books, handbooks, geographical guidebooks, encyclopaedias, professional literature (on social work) and university textbooks. **Classic novels** comprise fictional literature used by a single teacher trainee as an information source. The information channel used could not be identified.

**Personal files** cover a kind of scrapbook of information items acquired from various information sources and stored in physical folders or on personal computers. The analytic principle is that an information item such as a comic strip can be viewed as the information content sought for or, as a cutting, the medium carrying that information. The origin of the items stored in the personal files was often disregarded in the trainees' accounts. When accessed from the personal collection the information items become information sources regardless from where they were originally acquired. The information items stored in personal files included a set of PowerPoint slides, a report on an unspecified study, an unspecified article, a comic strip, a newspaper cutting, and a wholly unelaborated set of *materials*. One teacher trainee said that she stored her children's school art and exams in folders. While it would be possible to consider the children as an interpersonal resource (i.e., an information channel) enabling access to the schoolwork (an information source), the art and the exams were accessed from the personal collection during lesson planning.

**Periodicals** include (printed) newspapers and magazines but exclude academic journals, which the trainees did not use. The theme captures the accounts where periodicals were accessed specifically for use with the present lesson. The cuttings taken earlier from newspapers and magazines were considered personal files. Noteworthy, the periodicals were accessed from the personal collections and not, for example, from libraries. **Educational materials** comprise (printed) teacher's guides typically supplied with textbooks and other instructional material. The guides offer pedagogic instruction and guidelines on how to plan teaching. **Notes** consist of the trainees' own notes from lectures at the university and associated handouts typically distributed at the same lectures. **Personal photographs** are photographs taken by the trainees. The theme does not cover photographs as pictorial information sought from and carried by (other) information sources, such as textbooks and Websites; these would have been considered as personal files if stored in personal collections.

**Web** is an information channel providing access to information sources available on the *World Wide Web*. The theme is not concerned with full-text or reference databases available through the Web, because the contents of such databases are not generally accessible or the items are not immediately available over the Web. **Websites** cover specific and usually named interrelated collections of documents on the Web. These include organisational Websites and larger entities such as Wikipedia, the most often named Website. **Unspecified Web** covers the trainees' accounts where they spoke of the whole Web as an information source, calling it *Net*, *Google* or even *computer*, thereby leaving individual information sources on the Web unspecified and unnamed. Some trainees said that they could not remember which Websites they had accessed. Others cited search engines (i.e., *Google*) as information sources, in their words. Particularly images sought through *Google*

*Images* were spoken of separately from the information sources they were originally published in.

**Interpersonal resources** comprise the trainees' mediated or immediate, synchronous or asynchronous contacts with other people as (informal) information sources or as information channels to (formal) information sources. The people acting as interpersonal resources often also had the roles of intermediaries, referring to information sources available through other information channels but were not considered as information channels then. The **Mentoring teacher** (or mentor) assigned by the school to guide and tutor trainees was the person consulted most often as an information source. The **People** consulted as information sources included the method teacher at the university, a co-worker from a previous workplace, teacher colleagues, a researcher (at the university) and one teacher trainee's spouse. Fellow trainees observed in their training classes were not coded as people in this theme (*cf.* below). The **Video** refers to a documentary on a medium (either a VHS tape or a DVD disc) handed by the mentoring teacher to a teacher trainee.

**Libraries** encompass school, public and university libraries as accessed on the spot. The online library catalogues available through Web interfaces were the only type of database accessed by the teacher trainees. However, checking up online catalogues for references caught from Websites or hints received about relevant items, as useful as such referential information might have been to the teacher trainees, did not establish access to the items in the library. Such referential information was not directly useful in the performance of the task proper. The trainees had to physically visit the libraries anyway to hunt down the items, making the library the information channel.

**Observation** constituted an information channel where the trainees attended fellow trainees', and in one case a mentoring teacher's, lessons. Observation can be thought of as an information channel, enabling access to lessons as a kind of information source for information about teachers' didactic practices and students' behaviour. However, the teachers were directly observed in teaching and not communicated with. Consequently, the information acquired from the lessons was of the trainees' own making and did not involve representations, people or documents. The lessons – and the teachers and the pupils involved – were objects being observed and not information sources in the proper sense of the concept. It is of course possible that the trainees wrote down memos of their observations and later accessed them as information sources from their personal collections, but the data did not indicate that.

**Exhibitions** comprise public displays such as fairs and museum centres offering printed supplementary materials free of charge. As a type of information channel, exhibitions required a physical visit on the spot whilst the lesson was planned. (It is reasonable to assume that the materials gathered from exhibitions are typically stored in personal collections for future use.) The types of information sources acquired from exhibitions remained unknown. **Unknown** covers the data associated with the visits but lacking the detail to identify the type of information sources in question. The researcher supposes that these materials were brochures.

## trainees' modes of information acquisition

Table 2 summarises six modes of the trainees' information acquisition. The modes are organised to illustrate a continuum beginning with the most goal-oriented and ending up with the most serendipitous mode of information acquisition.

| Mode | n | % |
|---|---|---|
| Seeking known-items | 18 | 78 |
| Seeking with direction | 10 | 43 |
| Surveying the topic | 18 | 78 |
| Monitoring | 5 | 22 |
| Accidental encounters | 3 | 13 |
| Being given information | 5 | 22 |

**Table 2: Modes of information acquisition**

**Seeking known-items** occurred when the trainees returned to familiar information sources at known locations for information contents or items they were familiar with. Many trainees described seeking access by recall explicitly. One trainee articulated the core sense of the theme aptly:

> *I had originally found [the Website] for a completely different purpose... and I familiarised myself with [the Website] quite carefully at that time. Then, when planning this lesson, it occurred to me, that I could use [the Website]. (C5)*

A selection of quotations elaborate variation within the theme:

> *I wanted [a photograph] of the old Parliament [building], and I remembered that it's in the book. (C15)*
>
> *I've had that [Calvin and Hobbes strip] for a very long time, and I recalled it when I started [planning the lesson]. (C22)*
>
> *I'd been to [a museum] then at that time and I recalled... that [a display item] is associated with [the topic of the present lesson], and I remembered taking photos of it, and I got the photos from my blog.' (C19)*
>
> *[I used] lecture notes and handouts from courses, if I could remember that I've been to a course [on the topic]. (C1)*
>
> *I originally had [a book] as required reading on a course... at my freshman year and I've often returned to the book that way. (C8)*

The accounts show how the trainees recalled both information sources and items in information sources they had accessed in the past, before the task initiation. The trainee referring to his blog had recently taken a field trip with his class.

Some trainees expressed being familiar with relevant literature in general. Consider the following examples:

> *The lessons I have taught are topically quite **familiar** to me, and I already have quite clear conceptions from which books I'll go to get the information. (C11)*
>
> *In fact, I [already] knew quite a few of those books. (C2)*
>
> *[I was] thinking of the professional literature, which I was familiar with, that I've used. (C7)*

Some trainees' accounts on access by recall were implicit. For example, a few explained that they had recently planned lessons on similar topics and therefore already held relevant information sources. Others referred to their own course books from the university, their own textbooks from high school and training materials from courses they had been on. The theme was not coded as present if the trainees cited accessing known information sources such as their mentors to request references to unknown information sources (*cf.* below).

**Seeking with direction** occurred when the trainees did have clear ideas of what they were seeking (*cf.* below) but could not access relevant information sources or items in information sources by recall (*cf.* above). The trainees often expressed specificity by describing search goals of a factual nature. The following quotations are illustrative:

> *I went to the computer to search **when** the fortification work finally ended. (C14)*
>
> *There's a filosofia.fi-portal, which I visited pertaining to **Kant's Theory of Knowledge.** (C1)*

> *I went to the Web to see how the **names** of certain [political] parties are translated into English for they are certainly not in dictionaries. (C23)*

The trainees also cited seeking specific information (content) items. One elaborated her thinking aptly:

> *I [thought], there must be **a picture of the** [floor of the] **old parliament** [building] as there's one of the current... I was thinking, that these pictures must exist... I thought, that the parliament has been photographed through decades. (C23)*

Other items sought by the trainees and articulated as specific search goals include pictures of paintings, a historical document, photographs of President Kekkonen and selected topical politicians.

The trainees also conducted directed searches to access specific information sources. The following quotations exemplify the aspect:

> *I **checked** [from the library OPAC] **what books they have there** on the spot. (C22)*
>
> *I had to go to the library and choose **the latest [of an author]**. (C14)*

The former quotation may also be conceived as verifying and the latter as an example of chaining by the author's name. Yet another quote illustrates directed browsing from a selected starting point:

> *I **browsed through** last year's matriculation examinations for questions concerning [the topic of the lesson]. As the year 2006 was the 100th anniversary year of Parliament of Finland, I thought I would quite likely **find a question on this topic** and I did. (C23)*

Some trainees' accounts referred to meetings with their mentoring teachers. The following example raises an interesting point:

> *I **asked** the [mentoring] teacher **if I could photocopy these diagrams**, and she thought that, "if you copy a page or two, it won't matter". (C8)*

The trainee described asking the mentor a direct question about a copyright issue concerning a diagram that she had found from a book. The trainee was obviously familiar with the mentoring teacher as an information source. The direct nature of the question asked, however, suggests that the trainee was not verifying something she had known.

**Surveying the topic** occurred when the trainees conducted sweeping searches without expressing direction towards specific goals or pieces of information. In a broad sense, the trainees described topical surveying as '*Googling*': entering general topical search-keys in *Google*, browsing search-results and following links forward. The following quotations illustrate the idea:

> *One usually **Googles** and only then searches, I mean, **looks at what comes out of it**, and then follows the links forward. (C15)*
> ***It doesn't matter, what the words you search with are**... the information I'm searching for, it comes, kind of, from somewhere, that actual [information]. (C14)*
> *Quite often... I'm **skimming through** information and I'm usually on the Web quite a lot, kind of delving there, and therein really many wrong tracks may come, but sometimes the wrong tracks are quite worthwhile, you might find somewhere into those deep Web search engines or Websites about [a particular topic]. (C17)*

A trainee discussed a starting point of a broad topical survey:

> ***First read the [textbook] chapter** [on] that topic. Look for these key words... and gather them up, and then, from that basis, begin to develop [the search] forward, for example, by seeking information on the*

> *Internet, Wikipedia, Google. And then from [the Finnish history network] and others, where are these original documents... And if you can't find information on the Web, then it's time for a visit to the library. Then you'll search books with the key words. (C19)*

Topical surveying was not limited to the Web. A teacher trainee, for example, conducted a survey in the library OPAC. Some trainees described surveying within their personal collections or specific domains:

> *I have shelves full of [academic literature on the topic] at home and **I try to dig out** the in depth material from there if it's not on the Web. (C21)*
>
> *We **went through a reading list** with [the mentoring teacher]... there's quite a number of books on it, which one can look through, and that was it. (C2)*

The former quotation illustrates that the literature in the personal collection, while limited in scope, is not necessarily accessible by recall. Some trainees' descriptions of their negotiations with their mentoring teachers took the form of topical surveys:

> *We first met the mentoring teacher, who gave some tips on how [the topic] could be approached. We, then, asked questions, if we could do this or that, and the teacher then gave her own comments... what are issues that should be more closely dealt with. (C8)*
>
> *At first I chatted with my mentoring teacher a little about **what [the lesson] could cover**. (C2)*

Here, the trainees, rather than directly inquiring about a specific issue (cf. above), consulted the mentor concerning the overall topic of the lesson.

**Monitoring** occurred (or had occurred) when the trainees kept watch (or had kept watch) on certain information sources or places for information to use in the present (or a future) lesson plan. A teacher trainee described the mode as follows:

> *'**We were watching** all along what's for example in newspapers, what's in there, utilised and... gathered, and **we both had materials already from newspapers** before this. (C7)*

The quotation also illustrates how fluidly the trainees moved over the time dimension in their accounts by referring to their present and past monitoring activities. The trainees alluded to monitoring for prospective lesson plans:

> *Nowadays, I read newspapers with scissors in my hands as **I'm collecting all kinds of articles**, it's surely what's so important in our societal subjects, snatch everything you can. (C8)*
>
> *There **at the Educa-fair**, if there was anything relating to the things I was teaching, **I gathered all** of them for I thought that I might need them some day. (C8)*

The latter quotation also describes monitoring a place or a context for information sources rather than a source for information. Monitoring was the only mode of information acquisition that the trainees explicitly associated with gathering information to their personal collections to use it later.

**Accidental encounters** occurred when the trainees serendipitously found (1) information sources in situations where they were not seeking contact with information sources or (2) valuable information in information sources already at their hands. (The passive form in the theme's name is intentional.) Accidental encounters are often subject to the other modes of information acquisition, serving other ongoing tasks. This quotation illuminates both aspects:

> *[A dissertation] accidentally caught my eye in the library, as I was there digging in books for my masters thesis, and I then browsed it, and the diagram* ***happened to be there****. (C8)*

Another trainee (C9) explained how she was on a Website of the TV show *Big Brother*, hosted by a tabloid, when an unrelated item in the news feed '*caught her eye'*, and she picked up the news article for use in the lesson. It is noteworthy how a leisure time activity turned into a work related outcome. A quotation illustrates an accidental encounter when surveying another topic:

> *I was there [in the library] hanging around in front of the shelves, and, as this was a handbook of world history... I started browsing it and spotted [the picture]. I was* ***seeking information on [the topic]*** *at the same time but I was looking at* ***other history books there as well... and it caught my eye****. It was just* ***a lucky accident*** *that I found the picture. (C22)*

Thus, the trainee encountered information in a situation where the encounter was likely but not expected.

A quotation illustrates how the temporal dimension raised confusion about how to code the data:

> *[I]* ***encountered the diagram accidentally*** *in [a book], it was* ***a book given as a tip*** *to us by the mentoring teacher... It's a seminal work, and [the diagram] was there in that book. I actually* ***bought the book for myself****. (C8)*

The teacher trainee stated that an accidental encounter occurred. On the other hand, the account explicitly reads that the book had been bought from recommendation, meaning that the teacher trainee had been given information about a useful information source (cf. below). However, the teacher trainee had been referred to the book and not to the diagram, and the recommendation must have occurred in the past and not in the confines of the present task. Further, as the teacher trainee expressed owning the book, the occurrence could have been coded as seeking known-items (cf. above). However, the expression used suggests that the diagram was not purposefully sought by recall even though the book containing it was accessed from the personal collection.

The theme was not coded present superficially on any expression suggesting accidental encounters with information. While a trainee (C22), in a casual manner, used the expression 'by accident' concerning a book found in the library, the data showed that she had been purposefully surveying books on the topic from a library OPAC.

**Being given information** occurred when the trainees, without actively asking for help, were informed by information sources or directed to information sources by intermediaries (practically, mentors) working on their behalf. The following quotations elaborate three aspects of passive information acquisition:

> *I* ***got a tip*** *from the mentoring teacher, that [after plays] write on [the blackboard] a lot. (C4)*
>
> *That mentoring teacher, as she knew that I had to re-plan my lesson, she said that, as it is always so laborious to plan lessons,* ***she has a video****... "if you want to show it". (C22)*
>
> *I had books that were actually* ***recommended*** *by the mentoring teacher. (C6)*

The trainees were, thus, being (1) informed about (i.e., told), (2) handed information sources or (3) referred to information sources. As above, the trainees probably were already in contact with their mentors, and it is likely that they did not receive information completely serendipitously.

### Summary of the findings

The first research question was concerned with trainees' use of information channels and sources in lesson planning. The trainees used a repertoire of six information channels for the single lesson plan: the personal collection, the Web, interpersonal resources, libraries, observation and exhibitions. The information sources used for the lesson plan were of a broad scope as well, comprising both documentary and interpersonal sources, various media and content: general non-fiction, personal and educational.

The second research question was concerned with trainees' modes of information acquisition. The findings were conceptualised as a continuum beginning with the most goal-oriented and ending up with the most serendipitous mode. The trainees' modes of information acquisition were *Seeking known-items*, *Seeking with direction*, *Surveying the topic*, *Monitoring*, *Accidental encounters* and *Being given information*.

## Discussion

The findings corroborate the pilot study (Tanni *et al.* 2008) concerning trainees' use of information channels and sources, refining the role of the personal collection particularly. A short glance at the earlier studies gives an idea how the present findings relate. The earlier studies have identified (typically implicitly) the following information channels: (a) meetings, including workshops, courses, seminars and conventions; (b) conversations (i.e., interpersonal resources); (c) libraries, including school, district, university and public libraries; (d) personal collections; (e) radio and television; (f) computer retrieval or databases; (g) digital libraries; (h) the Web, (i) bulletin boards and mailing lists (Summers *et al.* 1983; Small *et al.* 1998; Merchant and Hepworth 2002; Perrault 2007). The information sources identified in the earlier studies are: (a) personal notes and files; (b) educational journals, newsletters and magazines; (c) curriculum materials; (d) people, including colleagues, experts and librarians; (e) textbooks, including college and university level textbooks; (f) books; (g) research reports and theses; (h) Websites; and (i) videos (Summers *et al.* 1983; Small *et al.* 1998; Merchant and Hepworth 2002; Perrault 2007). Summers *et al.* (1983) considered abstracts, indexes and bibliographies as information sources as well. In the present study, these were considered as search aids or tools, which do not contribute to the task proper.

Some of the information channels are characteristic and others incidental to lesson planning as a teacher’s work task. The use of personal collections and interpersonal resources is typical to professional work (Leckie *et al.* 1996). The personal collection performed a major role in the trainees' information acquisition by providing access to information sources of which some had been acquired in the past through external information channels while others were personal by origin. The use of personal collections suggests that trainees are planning for the long term at the end of their training year. The use of interpersonal resources such as colleagues is typical to teachers (see Kim and Roth 2011), and in the case of trainees these include the mentoring teacher as well. Observation on the other hand has not been identified as a teacher’s information channel in previous information seeking and retrieval studies. It is characteristic to teacher training, for trainees are required to comment other student teachers’ teaching. The information channel provides access to contextual information unavailable from documentary information sources. Visits to exhibitions are a rather incidental teacher’s information channel in lesson planning, its availability being dependent on the timing of field trips or teachers’ own leisure time interests. Both observation and visits do not seem to be purposively carried out for individual lesson plans, although the information acquired thereof may influence any ongoing lesson planning processes. The trainees' allusions to these two information channels suggest that different types of tasks can emerge simultaneously from teachers’ work roles (see Leckie *et al.* 1996) and trigger information acquisition over individual work tasks.

Research using the Leckie *et al.* (1996) model is prolific, but it typically does not address professionals in the role of educator, to which the present findings relate. An example of related research is the Borgman *et al.* (2005) study on a faculty of geography seeking information in the roles of researchers and teachers. The geographers were engaged in both active and passive modes of information acquisition, particularly in continual scanning (cf. *Monitoring*) of their information environment, in both roles. The roles were mutually reinforcing, leading to serendipitous encounters with relevant information (sources). (Borgman *et al.* 2005.) The present findings also suggest that some trainees, too, were not only thinking between various lesson plans in their information acquisition, but also switching between the roles of the practicing teacher and the student teacher, still working on their Masters' theses.

The trainees did not explicitly cite interpersonal resources, observations or exhibitions as information channels (see Appendix, question 5c), which their responses across the data nevertheless indicated. The findings may thus correspond with, but are not synonymous with, the conceptions the trainees may have regarding the channels. The number of trainees associated with the themes in Table 1 is thus likely to be lower than the actual number exploiting these information channels and the related sources. The interviews focused on a single lesson: the values might even out if the use of information channels and sources was considered over the whole training year. Most trainees observed their fellow trainees' training classes, at least if they were assigned to teach the same class later. It is also important to notice that the low number of trainees using personal photographs as information sources does not represent the trainees who sought photographs as pictorial information from other information sources. This paper is not concerned with the type of information the trainees obtained from information sources.

These findings corroborate and refine the pilot study (Tanni *et al.* 2008), which suggested that trainees' search goals vary substantially depending on how much they know about the topic and useful information sources in advance. The present findings show a broader picture of trainees' information acquisition extending beyond the present lesson plans and active or goal-orientated information seeking. The modes reflect a core characteristic of lesson planning: the task was being iterated over the training period, meaning that the trainees could capitalise on their earlier efforts, when acquiring information for the present lesson plans, and predict future tasks. Seeking known-items is an obvious example of the continuity. Merchant and Hepworth (2002) make a point about the use of familiar information sources such as textbooks as starting points before turning to sources in libraries or the Web. Erdelez (1997) and Foster and Ford (2003) point out that recognising value in accidentally encountered information sources requires past experiences or sense of contexts and situations where such information was or would be valuable. The present findings also show that the trainees moved across different problem areas or topics when accidentally encountering information (see Erdelez 1997). Clearly, teacher training and lesson planning are contexts and situations fostering accidental encounters with information sources. By monitoring, the trainees were not only seeking information for the present lesson plan but also explicitly preparing for future ones, thereby making *Monitoring* the only mode explicitly associated with the development of the personal collection. While teachers' monitoring is not explicitly discussed in the literature, the choice of information channels and sources (i.e., mass media) itself suggests that teachers monitor information sources (see Small *et al.* 1998).

McKenzie (2003) notes that models based on studies conducted in academic or workplace contexts tend to describe only active information seeking for present needs and, therefore, do not capture information acquisition for several inter-related present tasks, let alone for any future ones. Such models therefore do not recognise the whole variety of information acquisition. (McKenzie 2003.) Models derived from Kuhlthau's information search process are apt for describing systematic information seeking over a series of stages in the confines of

a single, present task. The process is based on school assignments, which typically are performed in relatively unfamiliar problem areas in isolation of other similar tasks. Task-based research, focusing on single tasks in isolation, does not consider the past or future tasks: personal collections, anticipation of information needs, and, consequently, make sense of accidental encounters or monitoring as modes of information acquisition. Furthermore, the information search process describing learning driven information seeking from the cognitive point of view fails to make sense of accidental encounters and passive information acquisition (i.e., *Being given information*). Lesson planning represents a task type that is iterative and invokes anticipative information acquisition on a time horizon extending beyond a single task. Continuity across individual tasks is an interesting characteristic discerning between types of tasks and the models able to describe them (see Ingwersen and Järvelin 2005: 75).

## Conclusions

Trainees use a broad selection of information channels and sources in lesson planning. trainees actively seek information for present lesson plans from external information sources, but the entirety of their information acquisition encompasses information sources acquired in the past and stored in the personal collection as well. The use of the personal information collection over the course of the task invokes the issue of personal information management, which, although not addressed in this paper, is clearly an important point to consider in task-based studies.

Trainees' information acquisition cannot be described only in terms of their present activities or goal-orientated information seeking behaviour. They access familiar information sources by recall, implying that past experiences of using the sources are relevant to present lesson plans. trainees anticipate and prepare for future tasks by monitoring information sources or places. Accidental encounters of information sources imply connections across time and topics. Therefore, continuity is an important characteristic of lesson planning as a task. It implies time as a central dimension of trainees' information acquisition. Future research on teachers' tasks should consider continuity across related individual tasks.

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## Appendices

### The Interview Schedule

1. What learning goals did you set for the pupils in the lesson plan?
2. What issues did you consider important to take into account when planning this lesson?
3. Could you describe in general how the lesson was planned?
4. For what purposes did you seek information when planning the lesson?
5. When seeking information for [the purpose],
    a. at what stage of lesson planning did this occur
    b. from what sources did you seek information
    c. where did you access these sources
    d. in which order did you seek information from these sources
    e. how did you seek access to these information sources
    f. on what grounds did you assess the suitability of the information sources you did find
    g. did you adapt the original materials and if you did how / what did you learn from this information?
6. What kind of lesson planning related work approaches do you have?
7. Do you store or save documents sought for lesson plans for future needs?
8. How do you organise the stored materials?
9. How much time did it take to plan the lesson?
10. Were you satisfied with the materials that you found for the lesson plan?
11. What did you learn about information seeking and use when planning this lesson?

The classroom observations were exploited to elaborate the question 4, if necessary. The questions from 5a to 5g were iterated for and adapted to each purpose articulated by the interviewee. There were two variations of the question 5g, because the teacher trainees' use of information depended on the purpose for which it was sought (see question 4).

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# CHAPTER 9

# Teacher trainees of the Internet Age: Changing conceptions of information literacy instruction?

**Mikko Tanni**

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The development of information and communication technologies (ICT), especially the Internet, has caused continuous change in the media and information environment and challenged the very basic practices of schooling. The challenges faced by schools have been addressed from various theoretical perspectives in literacy research, including the new literacies (Kuiper, Volman & Terwel 2005; Lankshear & Knobel 2003, 2007; Leu et al. 2004) and information literacy (Bruce 2008; Henri & Asselin 2005; Moore 2002). The new literacies perspective emphasizes how we, as members of social and cultural groups such as students and teachers, practise new literacies when we exploit the potential of the new technologies to 'do life' in the changing media and information environment (Gee 2008, Lankshear & Knobel 2007; Leu et al. 2004). The perspective of information literacy research is more focused on the issues of information seeking and use (Bruce 2008; Kuiper, Volman & Terwel 2005; Limberg 2005). Both perspectives share similar concerns about how schools reshape their pedagogic strategies and practices and adapt to the changes in the information and media environment.

The proponents of the new literacies have argued that there are differences in the ways that new media and information technologies are used by different generations. Lankshear and Knobel (2003) draw on an interesting theoretical construction to distinguish between the mindset of the 'insiders', who have grown up with the Internet, and that of the 'outsiders', who have been introduced to the use of new technologies later in life (Lankshear & Knobel 2003, pp. 32-3, 59-62). Teachers with little experience of meaningful use of new technologies for their own authentic purposes think as outsiders and try to transform their teaching practice into the Internet without changing the substance of their practice—much to

the irritation of their students' insider sensibilities. It is argued that young people are so significantly different from previous generations of students and teachers in technological skills and learning styles that they are alienated by their teachers' unsophisticated and inauthentic use of technology. An example of a blatant outsider application of the Internet in teaching is to allow students to access only preselected web sites and thus prevent them from using hyperlinks, the very foundation of the web (Lankshear & Knobel 2003, pp. 29-31, 66-69, 75; Leu et al. 2004).

Some studies on information literacy instruction have revealed similar problems related to teachers' difficulties in developing strategies and practices that work in the new information and media environment. For example, Limberg, Alexandersson, Lantz-Andersson and Folkesson (2008) summarized the findings of several studies and argued that teachers' focus on low-level skills frames information literacy as pressing the right keys and finding the right pages or web portals. For meaningful learning it would be important to support high-level aspects of information literacy like formulation of research questions and critical evaluation of information. However, the discursive practice of the school shapes the view of information seeking and learning as fact-finding (Limberg & Folkesson 2006). The challenge for researchers and teacher educators is to find a way to 'update' teachers' conceptions and professional practice that supports better practice in information literacy instruction embedded in formal education.

Teacher education is an important issue in the development of information literacy instruction practice for the new information and media environment (Hinchliffe 2003; Moore 2002). Unfortunately, little seems to be done to help teacher trainees incorporate information literacy instruction into their teaching practice (Asselin & Doiron 2003; Branch 2003; Childs et al. 2007; Hinchliffe 2003). Teacher education appears to proceed with the assumption that teacher trainees can transfer their information literacy skills into the classroom through their own learning experiences without being given sufficient scaffolding (Asselin & Doiron 2003).

Each year the group of students entering teacher education programs is likely to include more Internet insiders. The fundamental question is whether the teacher trainees of the Internet Age are able to address the problem of information literacy instruction with new pedagogic solutions and authentic applications of new technologies arising from their insider background. The premise of the question is that there are obvious differences in the ways that teacher trainees (insiders) and practising teachers (outsiders) understand the use of the Internet in information literacy instruction. If there are no major differences in the conceptions of different generations, the notion of the outsider mindset might not be relevant, and the

problems of both practising teachers and teacher trainees with information literacy instruction might originate in lack of proper pedagogic training for the new information environment.

Little research has been conducted on teacher trainees' conceptions of using the Internet in information literacy instruction. The chapter covers the results of a study that scrutinized how teacher trainees' conceptualize and weigh their own experiences of information seeking and use and how they conceptualize challenges in and practical solutions for teaching information seeking and use.

The study was conducted in collaboration with the Unit for Pedagogical Studies in Subject Teacher Education (http://www.uta.fi/laitokset/okl/tokl/english/) at the University of Tampere. Two collaborating teacher educators were consulted to recruit twenty-five recent graduates in history, social sciences and philosophy who were taking a one-year course to qualify as subject teachers. The students had teaching experience ranging from elementary schools to polytechnics. The unit adheres to the principle of experiential learning, in which teacher trainees' reflections on their personal experience form the focal point of learning to teach. The students were not formally trained in information literacy instruction.

A pilot study conducted in the previous year in the same setting indicated that prospective history teachers were capable of using a wide selection of information channels, including the Internet, for searching for information for their lesson plans and use various types of information sources in different formats. The trainees could also apply higher-order thinking skills in coping with information overload, adopt information-seeking strategies according to the situation, and select and adapt information to present it to their students (Tanni, Sormunen & Syvänen 2008).

## Teachers' conceptions of information literacy instruction

A central principle of both the new literacies and information literacy is critical thinking when one encounters information in a complex information environment (Leu et al. 2004; Reece 2007). Reece (2007) adapts the cognitive domain of Bloom's Taxonomy of Educational Objectives to distinguish between lower and higher orders on the continuum of information literacy. The lower order comprises the recall of relevant knowledge from long-term memory, the construction of meanings from information and the use of procedures in a situation. The higher-order thinking skills involve analysis, synthesis and evaluation of information. The

pedagogic premise is that the lower-order skills are necessary for the formation of the higher ones.

Williams and Wavell (2007) studied secondary school teachers' conceptions of information literacy. The conceptions include knowing how to access information sources to search for information and reading comprehension (for example, understanding information sources). Information literacy was also conceptualized as the ability to critically evaluate the quality of information sources (for example, for authorship and bias), and the use of higher-order thinking skills and previous knowledge on a topic to make sense of information from different sources. The teachers also shared conceptions of information literacy as mastering and using a range of lower- and higher-order skills and the independent use of the skills in different situations.

Williams and Wavell (2007) found that the teachers' conceptions of information literacy were linked with their sense of control over the development of students' information literacy. The teachers found knowing how to access information sources to search for information as the only conception that was easy to control. They recognized students' difficulties in interacting with information content, but, although they saw the importance of the problem, few could reflect on the problem, on their experiences of using information and on their understandings of constructivism and thinking skills in ways that could change their teaching approach and help students make sense of information. The teachers tended to conceptualize information literacy independently of the development of subject knowledge.

The literature offers more examples of teachers' perceptions of students' abilities (for example, Limberg 2005; Limberg & Folkesson 2006; Limberg et al. 2008). Teachers have observed the difficulties that students have in formulating researchable questions, evaluating information sources, reading various types of texts, analyzing and synthesizing information from different information sources and using time effectively (Limberg 2005). Teachers seem to recognize the whole range of the students' problems but limit their focus to the aspects of information literacy where they think they can influence their students' learning (Limberg & Folkesson 2006; Madden et al. 2005; Williams & Wavell 2007). For example, instruction in evaluating information sources emphasizes ways of critically assessing the authority of sources, but it is not concerned with the content of those sources. Furthermore, teachers might help students avoid making judgments and choices of their own by advising them about particular information sources. The ability to assess information sources is seen as a personal characteristic rather than a result of conscious learning.

Teachers emphasize the importance of students reflecting on their own knowledge and actions, formulating relevant questions, critically evaluating their sources, analyzing and synthesizing information from a variety of sources. However, these issues do not seem to be included in the content of teaching (Limberg 2005). Teachers often do not direct their efforts to information content, but focus on specific sources, demonstrating tools, recommending order for following between types of information sources and doing various parts of an assignment in the right order to accomplish the task. The focus of instruction is on procedural aspects of information literacy rather than on making conscious relevance judgments or critically evaluating information sources (Limberg 2005; Limberg & Folkesson 2006). Access to large amounts of information through new information and communication technologies only seems to strengthen the orientation towards the procedure, rather than towards encouragement and support of an understanding of complex issues (Limberg et al. 2008).

Limberg and her colleagues have identified the following critical features as fostering meaningful learning:

1. Teachers intervene in students' learning to help them to formulate questions, encouraging research rather than seeking discrete pieces of information (that is, facts), and devote time and effort to discussing with students the types of answers various types of questions might lead to.
2. Teachers observe a range of different aspects of students' information seeking including awareness of relevance criteria or judgments about enough information in situations of overload, and complement general guidance in the critical assessment of information sources with advice directly related to students' tasks.
3. Teachers focus on content in learning assignments (rather than procedures and technology) by challenging students' knowledge, leading students to conflicting information sources and negotiating learning goals to reach a common understanding of what the task is about (Limberg 2005; Limberg et al. 2008).

## Research design

### Research questions and data collection

The research tasks introduced in the study that this chapter is reporting were broken down into four specific research questions:

1. What challenges do teacher trainees experience in seeking and using information for lesson plans?
2. What experiences do teacher trainees consider transferable to teaching information seeking and use?
3. What challenges do teacher trainees identify in teaching information seeking and use?
4. What ideas do teacher trainees express for Internet-based exercises?

The first two research questions cover teacher trainees' experiences of information seeking and use by focusing first on challenges in general and then on the challenges that trainees find transferable to teaching. One should note that not all experiences might be considered as challenges and that some might be perceived as challenging but not transferable to teaching. The latter two research questions cover the trainees' conceptions of challenges in and ideas for practical solutions in teaching information seeking and use.

As the study was conducted at the early stage of an inquiry into teacher trainees' conceptions of information literacy instruction, an inductive, data-driven approach was adopted. The researcher interviewed the twenty-five teacher trainees recruited for the study individually, in Finnish, in May 2008, at the end of their training period. The questions, translated here from the Finnish, used to guide the semi-structured interviews were:

1. What was most challenging in seeking and using information in the making of lesson plans?
2. What did you learn from lesson planning that you could apply in teaching information seeking and use skills to students?
3. What would you consider the major challenge in teaching information seeking and use skills to students?
4. How would you plan a learning exercise in which students use mainly the Internet as an information source?

The data gathered consists of full transcripts of approximately two and half hours of tape-recorded interviews. The interview guide questions were emailed to the interviewees before their interviews, but whether or not they familiarized themselves with the questions in advance is not known.

## Data analysis

The Text Analysis Markup System (TAMS) Analyzer[1] was applied to the computer-assisted thematic analysis on the Finnish transcripts. Thematic analysis is a process for encoding qualitative information by using explicit codes. A theme is a pattern identified, at minimum, directly at the manifest level in the data or, at maximum, at the latent level as an interpretation of the data (Boyatzis 1998, pp. 4, 16-7, 166-7). A code comprises a label and a definition for a theme, and enables linking data and ideas about the data (Boyatzis 1998, pp. 31-2). The codes were developed from the data inductively, rather than derived from a theory and then applied to the data (Boyatzis 1998, pp. 41-51).

The unit of analysis is the entity on which the analysis will focus (Boyatzis 1998, pp. 62-3). The units were identified on the basis of discrete question–response pairs repeated across the data as a result of the use of the structured interview guide. The themes were then identified within (but not across) the responses (that is, the units of analysis). The unit of coding is 'the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon, (Boyatzis 1998, pp. 63-5). The unit of coding varied in length from a single sentence to several sentences over which a single idea or a conception was articulated. A unit of analysis could be assigned more than one code; a code could be assigned only to one unit of analysis. The codes were assigned exclusively to the segments of data, thus, the codes could not overlap. This protocol was adopted to increase discrimination and rigour in code development and assignment.[2]

A list of potential themes was produced from the reading of the data and initial descriptions of the themes were then written. Each segment of data was compared with the descriptions and assigned a code. Constant comparisons resulted in the descriptions of the themes being progressively clarified and the codes refined. Some coding decisions required the prioritizing of certain features or elements shared by two themes to differentiate between them. For example, paraphrasing from an advanced information source for students and translating a piece of information from a foreign language to Finnish are both experiences of challenges that deal with transforming information.

[1] TAMS (http://tamsys.sourceforge.net/) was adopted, because it is available for the Mac platform and enables viewing data in the form of tables, which facilitates the comparison of units of data.
[2] Some approaches to data analysis actually require the overlap of certain codes.

## Findings

The findings are presented here as tables and elaborated in the text. Each table represents the findings for a unit of analysis. The first column signifies the themes identified in the analysis. The second column stands for the number of different trainees expressing a conception associated with the theme. The last column sums up the key conceptions constituting the theme. Those themes that were supported only by a single trainee were discarded in the final results. The themes are summarized in the tables in the order of the number of interviewees associated with the theme, but the discussion is organized thematically in clusters of related themes.

### Experiences of challenges in information seeking and use

*Where to search* was a challenge concerning the choice of information channel, which was experienced particularly at the beginning of planning lessons on offbeat topics. A related theme is concerned with the *Difficulty to find or access* relevant information sources at all. One trainee, for example, had discovered that finding photographs of everyday life from 1960s was next to impossible.

**Table 9.1:** Experiences of challenges in information seeking and use

| Theme | N | Summary |
|---|---|---|
| *Discerning the essential* | 11 | the amount of (relevant) information / selecting the essential / finding the most important |
| *Where to search* | 4 | where to find/verify/look for information |
| *Finding information of acceptable quality* | 4 | finding trustworthy/accurate/deep/diverse information |
| *Suitability of information* | 4 | finding information that is suited for the class / that can be used with the class |
| *Settling on what is enough* | 3 | when to stop seeking information / how much information is needed for a lesson / balance the perceived need for more information and limited amount of time |
| *Difficulty to find or access* | 3 | sought information could not be found / (a book) was on loan |
| *Presenting information* | 3 | expressing and presenting information in a way the class can understand / processing pedagogic content from retrieved information |
| *Foreign language* | 3 | no time to translate / reading English web pages |
| *Differences in textbooks* | 2 | choosing between different textbooks |

The challenge concerning *Settling on what is enough* is illustrated by the following expression: ‘in a way they are against each other, in one way, casualness and criticalness, should I check for more sources, and on the other, the limited amount of time’. The theme captures the challenge of deciding how much information is needed for a particular lesson and balancing it with the limited amount of time available. *Discerning the essential* or the important in the amount of available information, to answer questions such as ‘what to choose for the lesson, what would serve students’ best’, was experienced as a challenge by many. The two themes are close in meaning, but the former focuses on how much information is needed for a lesson and the latter on the challenge of framing the topic.

*Finding information of acceptable quality* illustrates the challenge of finding ‘trustworthy’, ‘accurate’, ‘deep’ and ‘diverse’ information. The trainees evaluated *Suitability of information* on the basis of what they thought the class could comprehend and how difficult they rated the information. A trainee said that it was challenging ‘to find the information that is the most useful for the students, such [information] that is understandable for them as well and not just for me’. Few trainees perceived a challenge to choose due to *Differences in textbooks*.

The theme *Presenting information* encompasses the challenge of processing usable ‘pedagogic content’ of retrieved information and presenting it to students in a way they can understand. A related theme encompasses the challenges of translating or reading information in a *Foreign language* because of lack of time or insufficient vocabulary. The themes are related, as they both involve transforming information from one form to another, but the latter is characterized by the unique ‘language’ element, which was given a priority.

### Experiences transferable to teaching information seeking and use

A general theme captures the experiences of *Information seeking* expressed in various level of specificity. Some trainees were more general, citing ‘being more systematic and flexible in information seeking’ as the experiences of potential use in teaching. Others were more practical: ‘start with single words rather than a long sentences if googling something’, as one trainee responded.

**Table 9.2:** Experiences found transferable to teaching information seeking and use

| Theme | N | Summary |
|---|---|---|
| *Assessing information sources* | 11 | what kind of information sources are trustworthy / how to assess information sources / assess the authorship of information on the web / be critical of the information sources on the web |
| *Information seeking* | 9 | where to seek information / how to search information (on the web) / use various information channels / be more systematic and flexible in information seeking |
| *Not transferable to teaching* | 4 | the trainee did not experience anything of potential use in teaching information seeking and use |
| *Discerning the essential* | 3 | to take a broad view on the whole and then focus on specifics / pick the most important |
| *Comparing information sources* | 2 | comparing different information sources to verify a piece of information |

The most frequently articulated theme in this unit of analysis is about *Assessing information sources*. Trustworthiness and authorship were given as the criteria. A trainee elaborates the theme: 'The issue of trustworthiness … is something I've clearly learned about, what skills I can call my strongest are the ones I can pass on to the students, that question the original texts.' A related theme encompasses the experiences of *Comparing information sources* to verify a piece of information. A theme about *Discerning the essential* was identified in this unit of analysis as well. A trainee explained how she had grown to use the contents (of books) to focus only to the most essential in lessons and the experience helped her to advise students to try to grasp the whole rather than the details.

Some trainees found that their experiences of information seeking and use were *Not transferable to teaching* at all. The theme was developed irrespective of the trainees who hesitated in their responses but eventually did.

### Perceived challenges in teaching information seeking and use

The most frequently articulated theme on the perceived challenges in teaching information seeking and use encompasses critical *Assessment of information sources*. The trainees did not elaborate the substance of being critical, but many did express that they wanted students to be discerning, in the sense of not being satisfied with the first source retrieved. In addition, one trainee said: 'the biggest challenge is that, in a way, you guide [students] to trustworthy information and

teach them how to assess trustworthiness and regard certain information sources critically.'

**Table 9.3:** Perceived challenges in teaching information seeking and use

| Theme | N | Summary |
|---|---|---|
| *The assessment of information sources* | 15 | to get students take a critical view on information sources / be discerning / assess the trustworthiness of web sites |
| *Teacher trainees' lack of skills* | 11 | the perception of insufficient skills to use databases / assess information sources / seek information / use the web and ICT |
| *Lack of motivation* | 4 | students do not want to seek information / expect that the teacher should get the information for them |
| *Understand subject content* | 3 | to get students discern the essential / understand the inexact nature of historical knowledge / that there are no ready-made answers |
| *Plagiarism* | 2 | prevent copying and pasting from Wikipedia |
| *Information seeking instruction* | 2 | to get students started off in searching information on the web / get students to use libraries and archives besides the web |
| *Students' lack of skills* | 2 | students' lack of computer skills / ability to search information on the web |
| *Finding the time* | 2 | find the time for information seeking and use instruction in subject teaching |

A theme was identified from two almost diametrically opposed expressions concerning *Information seeking instruction* and the web; one trainee perceived a challenge in getting students started in searching information on the web (that is, the use of an information channel), whereas another wanted students to use other information channels besides the web (that is, the choice of an information channel). The theme, getting students to *Understand subject content*, is open to interpretation. It captures the idea that learning (history) goes beyond seeking facts (that is, ready-made answers) and that students should learn to discern the essential in the amount of relevant information.

The trainees found preventing *Plagiarism*—manifested as copying and pasting information from Wikipedia—to be a challenge. A trainee wanted to make sure that students understand 'what it means that they are seeking information…and they should in a way rewrite [the retrieved text] and not copy a word for a word from it'. The theme about students' *Lack of motivation* covers the trainees'

perception that students expect the teacher to provide the information rather than assignments to seek information.

A major theme was identified in expressions about *Teacher trainees' lack of skills*: 'I feel that my information seeking skills are not necessarily the best possible', was a typical expression; 'I can't use [the Internet], so I get the books, because they feel more safe', was another more specific expression of the same theme. Some trainees framed the challenge as being 'as good as students'. Fewer in number were the expressions concerning *Students' lack of skills* in using information and communication technologies to search for information. A minor theme comprised the expressions on how the curriculum and tight schedules reserved for subject teaching made *Finding the time* for teaching information seeking and use difficult.

### Ideas for Internet-based exercises

A theme about setting up the *Task assignment* was identified. A trainee had realized that

> the task must be really well introduced…it must introduced orally and in writing, give fairly free hands [that is, work independently], the phrasing of the question must be good, one that concentrates at answering the question, takes a proper amount of time and…focuses on the kind of things…that it teaches [the students] to think for themselves.

However, the conceptions of the task assignment varied in the freedom given to students: '[I gave] really specific instructions, that one had to proceed from a site to the next one according to the worksheet, and I noticed that it was quite necessary that [the task] is well instructed and that they know all along where they are going next.' A theme related to the task assignment captures the idea of *Verifying the availability* of relevant information before the task is initiated. (The logical connection between these two conceptions is not explicit in the data.)

**Table 9.4:** Ideas for Internet-based exercises

| Theme | N | Summary |
|---|---|---|
| *Task assignment* | 9 | give clear instructions for what to do (next) / set proper scope for the task / have means to control that students have pondered the issues and not plagiarized / phrase questions properly to encourage independent thinking/creativity/finding the right things |
| *The assessment of information sources* | 6 | to demonstrate that not all information on the web is accurate / get students take a critical view on information on the web / to ponder the trustworthiness of information in Wikipedia |
| *Guiding students* | 5 | assess information sources together with students / plan searches together with students |
| *The diversity of information sources* | 4 | get students to use various information sources / different types of information sources |
| *Information seeking instruction* | 4 | introduce the students to what kind of information sources are available / instruct how to search information on the web / recommend web sites |
| *Verifying availability* | 4 | verify that relevant information is available and accessible |
| *Processing information* | 3 | get students to process retrieved information / produce a text assessing retrieved information / discourage plagiarism |
| *Keeping the class in control* | 3 | keep students away from non-topical Web sites / oversee students' behavior |
| *Comparing information sources* | 2 | make students compare information in and between different web pages and the textbook |
| *Restricting access* | 2 | restrict access to a particular web site |

Two themes related to but articulated independently of the *Task assignment* theme captured the trainees' need to control students' information-seeking behaviour. The theme *Keeping the class in control* captures the idea of keeping students occupied with the task by preventing them from seeking entertainment in unwanted web pages. A stricter variant of the theme captures the idea of *Restricting access* to a few pre-selected web pages only.

A theme about *Information seeking instruction* was identified: 'One should at least in the beginning tell and teach about different channels through which one can begin to search information', responded a trainee. The focus of the theme is not on the form of the task assignment as above but on ensuring that students have the

necessary knowledge of available information channels and sources. The focus of a closely related theme is on *Guiding students*, with active intervention in their task performance rather than with advice given before the performance. A trainee outlined an exercise:

> we'd go to a computer lab together, and then I'd assign exercises to the students…search information let's say about substance abuse…and I'll come to check what they've found. And that way, as they'd be searching, and I'd be there as well, kind of together with them assessing [the information], so at least this way one could direct [students' learning].

The *Assessment of information sources* is a theme aptly illustrated in the following: 'I would try to demonstrate to the students…I would try to make them realize that not all information on the Net is necessarily that scientific or accurate.' Another theme captures the idea of students using a *Diversity of information sources* as opposed to leaning from a single source. One trainee meant diversity in the sense of using information in different forms and media. Few trainees brought up the idea of *Comparing information sources*, but one elaborated particularly and wanted to plan an exercise 'where [students] have to seek information…from various different sources and specifically pay attention to the differences in the content…so it would become clear that there's not just that one truth but [the truth] can be expressed differently in different places'. The trainees articulated ideas about *Processing information* to address students' tendency to copy and paste acquired information directly.

## Discussion

### What challenges do teacher trainees experience in seeking and using information for lesson plans?

Andrew Madden and his colleagues (2005) conducted a survey on practising teachers' conceptions of using the Internet in teaching. The results show that younger teachers had more experience in using the Internet than older teachers. The older teachers found it difficult to use search engines, were less confident in their ability to use the Internet, less convinced of its importance in teaching, used it less with classes, felt under more pressure to use the Internet, believed that students know more than they do about the Internet and had more confidence in students' ability to use the Internet to search for information (Madden et al. 2005). Penny Moore (2002) reports on a study of practising teachers who had difficulties in

distinguishing between relevant and irrelevant information and perceived themselves as more able to use the old rather than the new technologies.

The findings of the study reported in this chapter show that the teacher trainees' did not consider the use of the Internet as a challenge, even though they were aware of the problems in achieving their search goals with the new technology. The trainees gave descriptions of experiences concerning information seeking and use that were similar to those who participated in the pilot study (Tanni, Sormunen & Syvänen 2008). The majority of the challenges identified were related to use of information—discerning the essential, assessing, processing and translating retrieved information with the understanding of the class in mind. The trainees perceived also that it was not enough to consider the authorship of an information source only; the content of information provided in the source had to be suitable—usable for the purpose of teaching someone else. It is reasonable to conclude that the teacher trainees are aware of a range of different issues related to seeking and using information through their own experiences and that they use higher-order thinking skills successfully for the task.

### What experiences do teacher trainees consider transferable to teaching information seeking and use?

The number of trainees who cited finding information of acceptable quality as a challenge was less than a half the number of trainees who found the experience of assessing information sources to be transferable to teaching. Likewise, the number of trainees who found the choice of an information channel as a challenge (see the theme *Where to search*) is half the number of trainees who found their various experiences of information seeking to be transferable to teaching. Further, only a few trainees considered the challenge of *Discerning the essential* transferable.

While the findings are not completely clear, it seems that the trainees found their experiences in using higher-order thinking skills less transferable to teaching than their experiences in applying practical skills. The complexity of the range of experiences available for the trainees to exploit in teaching, including interpretation and generation of information and negotiation involving students' comprehension and available resources, was reduced to the more manageable recommendations of where to seek information and how to assess the authority of information sources. These findings are supported by earlier research (for example, Limberg & Folkesson 2006; Williams & Wavell 2007), where teachers' focus on practical and procedural aspects of information literacy is highlighted.

### What challenges do teacher trainees perceive in teaching information seeking and use?

The trainees found that their experiences of assessing information sources would be applicable for teaching information seeking and use and that teaching the assessment of information sources would be a major challenge. It was unexpected to see that so many teacher trainees found their own information searching and ICT skills lacking. The use of technology did not emerge as a major challenge in the trainees' experiences of seeking and using information for lesson plans, a finding consistent with those of the pilot study (Tanni, Sormunen & Syvänen 2008). Madden and his colleagues (2005) found out that most (72%) practising teachers are confident in their ability to use the Internet, although half of the teachers studied found that students know more about the Internet than they do. The findings might be an indication of the trainees' low self-efficacy because of the lack of training in teaching information searching using new technologies, if not an indication of an actual lack in the trainees' skills.

Although the trainees did articulate themes that focused on higher-order thinking (preventing plagiarism and getting students to understand and discern subject content), they articulated equally the themes that focused on lower-order skills, or even on the rudimentary issues of organizing a class teaching information seeking and use. If a trainee struggles to find the time for information literacy instruction (see Madden et al. 2005) and finds students' ICT skills lacking or the students unmotivated to seek information independently, it is not surprising that the teacher does not have far-reaching goals for integrating information seeking and use instruction into subject teaching.

The perception of students' lack of motivation, if accurate, could indicate students' reactions to teachers' outsider applications of new technologies. Another interpretation is that it is the students who are stuck with the school mentality, expect that the teacher to be the sole source of knowledge and find task assignments requiring independent information seeking as curious exceptions of this rule (see Lankshear & Knobel 2003, pp. 30-1). As for the trainees' perception of students' lack of skills, Bennett, Maton and Kervin (2008) point out that students might indeed know how to use the Internet for their own purposes, but that this knowledge might not be applicable in searching for information using new technologies for school assignments.

**What ideas do teacher trainees have for Internet-based exercises?**

The findings show that the trainees' ideas for intervention in students' tasks are limited to advising them about the procedure of information seeking instead of addressing the content of students' tasks directly. The findings include the notion of the teacher phrasing 'good' questions for students in the task assignment, but the conception of intervening in a student's task to help them to formulate research questions is not present in the data (see Limberg et al. 2008). The trainees did acknowledge certain aspects of information seeking, but the concept of enough information, although it was perceived as a challenge in information seeking, was not addressed in the ideas for the exercise. There are some indications of the trainees leading students to conflicting information sources to challenge their knowledge, but the reasoning is not explicitly articulated in the data (see Limberg et al. 2008). The trainees cited few examples of their own teaching and did not discuss the ideas for the exercise in relation to the content of their subject teaching (see Williams & Wavell 2007). The findings add to the body of research demonstrating that both teachers' and teacher trainees' interactions with students tend to focus more on procedural issues, and only few know how to use questioning to focus discussion on what pupils are learning and help them to develop their ideas (see Childs et al. 2007; Limberg et al. 2008; Williams & Wavell 2007).

For the most part, the trainees' ideas constitute general goals rather than practical solutions for teaching information seeking and use. Learning outcomes are described, but means of achieving them are rarely articulated. For example, the assessment of information sources, which the trainees identified as a challenge in teaching information seeking and use, re-emerges in the ideas for the exercise, but the trainees did not go beyond repeating their earlier views. Equally, the trainees did acknowledge the problem of plagiarism, but their ideas for the most part fall short of practical solutions. One trainee felicitously pointed out that just by telling the students to be critical does not carry one very far in the classroom. It is important to keep in mind the discrepancy found by Limberg and Folkesson (2006) between teachers' conceptions of the goals of information literacy instruction and what they actually engage with in teaching. It seems that both teacher trainees and practising teachers do not always have the means to address issues they have perceived in their students' learning (Childs et al. 2007; Williams & Wavell 2007).

The findings show also that the trainees used learning assignments as a device to direct and manage students' learning in advance. This and a number of other themes—verification of the availability of relevant information, keeping students away from unwanted web pages and restricting access to particular web sites—

suggest that the trainees saw that it was vital to remain in control of the situation. Ann Childs and her colleagues (2007) point out that teacher trainees might see exercises to be ways of keeping in control of the class as much as carefully considered pedagogic devices. Lankshear and Knobel (2003, pp. 74-7) argue that attempts to tightly regulate students' information behaviour (for example, by restricting access to selected web pages on the Internet) are a demonstration of outsider mentality, which alienates already skilled students and prevents others from learning by doing and experimenting with the technology.

## Conclusion

The study contributes to the limited body of research addressing teacher trainees' conceptions of information literacy instruction. Teacher trainees' own experiences of information seeking and use were explored and they were also asked how they would develop their students' information literacy. The empirical findings of the study indicate that:

- regardless of using higher-order thinking skills in their own information seeking and use, lower-order skills dominate teacher trainees' conceptions of information literacy instruction, and;
- teacher trainees do recognize a range of problems in students' information behaviour, such as plagiarism and the use of few information sources, but do not seem to be able to offer practical solutions to address such problems.

When considering the findings, one should bear in mind that the interviews did not focus on a particular lesson or a topic. The way the interviews were conducted might have led the trainees to discuss their conceptions only on a generic level. Further research on the topic should address similar research questions in the context of the subject content of a particular class and the exercises involved with that class.

The findings have implications for the directions that teacher educators should consider in training future teachers in making use of the new information environment. It does not seem reasonable to assume that teacher trainees can translate their experiences of information seeking and use into effective pedagogic applications without being trained in how to do so. It also seems that growing up with the new information environment does not lead to new pedagogic innovations. Without training for information literacy instruction in the new information environment, teacher trainees seem to produce the same patterns of conceptions as practising teachers, even though they have grown up with the new technologies.

The situation calls for action on the part of teacher educators, because the literature offers evidence of the effectiveness of training teachers for information literacy instruction and also makes explicit recommendations for doing so (see Branch 2003; Hinchliffe 2003; Moore 2002).

Bennett, Maton and Kervin (2008) have argued that the adoption of the new technologies is not related to a distinct generation at all, because the variance in the use of the new technologies within a generation could be as significant as the differences between generations. Future research should address teacher trainees and practising teachers, as groups and as individuals, to elaborate on the differences—if there are any—in their experiences of information seeking and use, and the ways they adopt new information and communication technologies in information literacy instruction. Such research should take into account that research on teacher trainees may become out-of-date quickly, because the generation of students entering teacher education programs becomes arguably more Internet-native every year.

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