Changing Conditions for Information Use and Learning in Swedish Schools

A Synthesis of Research[1]

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This article presents findings from a series of research studies conducted between 1998 and 2010 on the ways in which knowledge formation occurs through students' own research and on the interaction between information seeking and use and learning. Our point of departure is that information seeking and learning are closely interwoven in constantly on-going human activity. Our studies have directed particular interest to the ways in which information and communication technologies (ICTs) and new digital media shape conditions for learning. The research design was inspired by ethnographical studies, including observations, field notes, video recordings, interviews, questionnaires and documents produced in the practices studied. In the present article we have chosen to focus on four main findings common to the series of research projects, which together indicate not only changes within schools but also on a structural level. Firstly, we claim that the new digital tools which mediate information seeking and learning change the conditions for learning itself. Secondly, information seeking via new technologies changes conditions for how students assume responsibility and construct knowledge. Thirdly, new conditions for the division of responsibility and meaning-making were identified throughout all six projects. The fourth main finding concerns how the communicative structures of school were

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changed. We suggest that these four main findings contribute to an understanding of a gradual shift in the school discourse, which took place during the first decade of this millennium.

Keywords: information and communication technology (ICT), information literacy, information seeking, information use, Swedish schools

During the last decades comprehensive changes took place within Swedish schools; from teacher directed instruction to student-centred learning methods – more often than not in the form of independent *research*[2] via the computer. This transition was based on ideas about teaching and learning that encouraged students' independent search for knowledge, their assumption of a personal responsibility for learning and for the planning of time and procedures connected to their own work. These changes have had a remarkable impact in Swedish schools during the last decade. The breakthrough of student-centred working methods that require independent information seeking and use, mediated via the computer has contributed to the increased use of services offered by libraries on all levels of education. This in turn has led to an increased interest in pedagogical issues among librarians, particularly in relation to information literacy education.

This article presents findings from a series of research projects on the ways in which knowledge formation occurs through students' *research* and on the interaction between information seeking and use and learning. Our point of departure is that information seeking and learning are closely interwoven in constantly on-going human activity (cf. Limberg & Alexandersson 2010). The relationship between information seeking and learning in focus in this article pertains to information seeking for learning purposes, where information seeking is carried out for a purpose beyond itself, and where students' learning about some topic or issue is the overall interest. Our interest was also directed at students' ways of learn-

ing how to engage purposefully with information tools and sources while working with their assignments. We use the concept of information literacy for designating abilities to seek and use information in purposeful ways for accomplishing some task, such as a school assignment (cf. Limberg, Sundin & Talja this issue). Our studies have directed a particularly strong interest to the ways in which information and communication technologies and new digital media have changed the conditions for learning in such situations.

New Technologies Changed the Conditions for All Learning

Towards the end of the 20th century dramatic societal changes took place with the breakthrough of new information and communication technologies (ICTs). Expectations that systems of education should adapt to these changes were strong (Kozma 2003). For instance, computers were supposed to quickly and efficiently become tools for student learning, something that was pointed out in a series of Swedish government committee reports and political decisions during the 1990's. However, an OECD report questioned the powerful rhetorical claims that ICT as such would promote changes in student learning (OECD 2006). It can even be claimed that expectations about the digitalisation of schools were not fulfilled (Bell 2007). According to Venezky and Davis (2002) and Cox and Marshall (2007) there will be little development in schools without ideas about how and for what the new technologies might be used. Nevertheless, according to both national and international studies young people's computer use in their leisure time has developed dramatically (Alexandersson, Hurtig & Söderlund 2006; Cuban 2001; Erstad 2006; Harrison *et al.* 2003; OECD 2006; Younie 2006).

In spite of uncertain and sometimes contradictory findings about the benefits of new technology as regards educational change, efforts continue to further develop ways of using it in educational activities. During the last few years, a large number of new web tools have been constructed that may facilitate the interaction between students for collaboration on

various tasks and knowledge content. At the same time, teachers and librarians point out difficulties for students to critically evaluate the credibility of information in tools such as Wikipedia. It may be true to say that Wikipedia offers new possibilities for student learning but also offers new environments for knowledge formation on the internet (Francke, Sundin & Limberg 2011; Sundin & Francke 2009).

Our twelve years' of experiences and research focusing on information use and learning have led to insights that technology as such does not change the quality of learning in a straightforward way; an increasing number of computers does not automatically lead to improved learning. Today the earlier strong optimism about ICT as a catalyst of change seems to be replaced by a more realistic view of technology and its potential as a carrier of change. From this follows that technology is integrated into teaching in schools and has become one tool among others. Our studies indicate, in fact, that traditional school activities tend to shape ICT rather than the other way round (Alexandersson *et al*. 2007; Alexandersson & Limberg 2003; Alexandersson, Linderoth & Lindö 2001).

The Studies and Their Theoretical Points of Departure

A common focus of the six research projects that we conducted during the period 1998–2010 concerns the conditions for teaching, interaction, and learning in school and library practices as well as the ways in which collective and student-centred working methods lead to intended and unintended learning outcomes. Table 1 below provides an overview of the projects which form the basis of this article.

Years	Projects
1998–2000	Learning via information technology
2000–2002	The content of learning and new information technology
2001–2003	Learning via the school library
2003–2005	Students' learning via ICT in Sandviken, Sweden
2004–2007	Design and implementation of digital learning resources
2008–2010	Expertise, authority and control on the Internet

Table 1. Overview of research projects 1998–2010.

In this article we bring out some dimensions that cut across the different research projects. These dimensions relate to students' own *research* and more specifically to the ways in which students transform information into knowledge. This is linked to the ways in which information literacies are enacted as well as ways in which new school practices are shaped through the information technologies used in these practices. Our theoretical point of departure is that from their own experiences and personal aptitudes students construct their knowledge and worldviews through dialectic interaction with the environment, constituted for example by the school and library settings. In this interaction, fellow students, teachers, and librarians become central actors.

Various theoretical frameworks on human linguistic and communicative interaction have guided our research. Among these are descriptions of the characteristics and functions of language in sociocultural contexts according to Berger and Luckmann (1966), Wertsch (1991; 1998) and Wittgenstein (1953). They share the view that it is through language that people are able to communicate, share experiences and represent knowledge – individually as well as collectively. Through these communicative activities social relations are shaped and maintained. When the students whom we studied worked with information seeking, they used resources such as written and spoken language, moving and still images, music,

sound, and colours, in order to present, describe, and evaluate their knowledge and abilities. They were expected to learn how to use the particular expressions offered by the digital resources in order to seek information on the internet, based in their own interests and, at the same time, in accordance with the requirements of particular school tasks. This entails a large number of decisions, such as the selection of texts, images, and sound. The information that they then write or talk about (the object) and the information seeking that they carry out (their activities) form part of their language use. In line with Wittgenstein (1953, § 27), we thus studied the *language games* of students working with assignments in classrooms and libraries.

For the purpose of analysing students' information seeking and learning with a basis in these ideas on language use, we used sociocultural theory (Säljö 2000; Wertsch 1998). This theory offers analytical tools for understanding students' construction of meaning in relation to the context in which their work, using the new technology, occurred. While seeking information in classrooms or libraries students will find themselves in a context where they are expected to record – orally or in writing – their decisions about ways of and reasons for selecting certain information. Language becomes a tool for communicating and constructing meaning, via conversations about the information that students are working with.

The design of our various studies was inspired by ethnographical methods, including spending a lot of time in classrooms and libraries, observing information and learning activities through the interaction between students, adults and cultural tools (material and linguistic). Our empirical material thus consists of field notes from observations, video recordings, interviews and questionnaires, as well as documents produced in the settings by students and educators. Altogether, the empirical material includes some 1500 pages of field-notes from 265 observation sessions in 45 classrooms and libraries, 46 hours' video documentation and 20 hours' audio recordings of activities in classrooms and libraries. There are 185 hours' interviews (individual and group with students), 35

interviews with educators (teachers and librarians), and 688 questionnaire responses from surveys with students. Some 800 students (aged 6–19 years), 50 teachers, and 15 librarians in 18 schools (from lower preschool to upper secondary) participated in our projects. The empirical material further includes compilations of several hundred information sources used by students, such as web pages, copies of book pages and other print material, and some 200 documents produced by the students (essays, booklets, reports) as well as 60 student produced blogs. The material also comprises teachers' written instructions, school documents, and two interviews with designers and producers of educational software.

A Synthesis of the Research Projects

During the period when we conducted our six research projects (1998–2010) the comprehensive changes, referred to above, from teacher-centred instruction to student-centred, explorative work were happening. A common term for this type of pedagogy is "self-directed learning" or "inquiry-based learning", which is inspired by democratic ideals aiming at offering students improved possibilities for actively participating in their own learning; it also aims at increasing the freedom for teachers to provide support to students with special needs. The objective that students should have an influence on teaching implies an idea that each student is able to construct his/her own knowledge. This idea is connected to the assumption that people learn better when knowledge is part of a wider context, carries meaning for learners, and takes place in a setting which is motivating for them. According to the national curriculum,[3] explorative ways of working were expected to improve the quality of students' learning. These working methods reflect the goals of democracy in the national curriculum – and so of education; this is to say that schools should educate students to become active, responsible citizens who understand the value of collaboration with others. The curriculum further emphasised that students should gradually take an increasing

responsibility for their own learning and that during their school years they should learn how to critically manage large quantities of information.

This complex process of change in the Swedish school system forms the background of our research projects. In the present article we have chosen to focus on four main findings common to the different research projects. They indicate changes *within* school, as well as changes on a structural level. Firstly, we claim that information seeking and learning that is mediated via new digital tools change the conditions for learning itself – both for ways of learning and for what is being learnt. This concerns students' ways of transforming information into knowledge; the interaction between information use and learning. Secondly, information seeking via new technologies changes conditions for students' assumption of responsibility and also for the ways in which they construct knowledge. This involves a number of critical features, such as researchable questions guiding students' work, various aspects of information literacy to be explicitly taken into account, and the importance of consistent and meaningful feed-back between educators and students. Thirdly, we identified new conditions for the division of responsibility and meaning-making throughout all our projects. The fourth main finding concerns how the communicative structures of school underwent change. We suggest that these four main findings contribute to an understanding of a shift in school discourse which was gradually reshaped during the first decade of this millennium. In the following, we will present the main findings as four dimensions.

The First Dimension: New Conditions for Learning

As mentioned above, we propose that information seeking and learning that is mediated via new digital tools change the conditions for learning itself – both for ways of learning and for what is being learnt. This concerns students' ways of transforming information into knowledge, which in turn refers to the interaction between information use and learning. Our findings indicate that the quality of students' ways of

seeking and using information closely interacts with the quality of their learning outcomes (Alexandersson *et al.* 2007; Alexandersson & Runesson 2006; Limberg 1999; Limberg 2007). While engaged in information seeking, students used different strategies of action based in various interests and ways of understanding their assignments. The majority of students focussed on the computer as a technological tool, but there were examples of intense searching for meaningful content, thus aiming beyond the technology. However, procedural strategies were predominant, since this provided technological feed-back; *pressing* the right key or *marking* the right text section with the mouse, *writing* the right search term or *finding* the right web site, *browsing* texts or pictures in the right way or *printing* the text or picture intended for use. Similar technological approaches were adopted for seeking and using print material as information resources. They were concerned with finding the right book and finding the right text section and pictures. "Right" was equivalent to "topical" and suitable for copying. Students tended to carry out their tasks without a great deal of effort. The goal seemed to be to swiftly accomplish one task in order to immediately engage in the next (cf. Krange & Ludvigsen 2008). These procedures formed the basis of students' searching for meaning. Our conclusion is that the task which students had to carry out – to find information on their topics – linked to students' ways of transporting and transforming texts together shape a particular school practice. Within this practice students' opportunities for learning something of the selected topical area, in a real sense, were limited since thinking about issues related to terms, concepts and relationships does not appear as relevant to them.

In our analyses we have been sceptical to students' simple searching for facts. However, this does not imply that we question the significance of factual knowledge. Rather, this concerns what kind of factual knowledge that students learn. We identify two kinds of factual knowledge that we label *type I* and *type II* facts respectively. While the former tends to be disconnected from wider contexts and have the character of right or

wrong, the latter is constituted of connected facts which together form parts of an imagined whole and which is of a more relative nature. The recurring statement that "students only look for facts" therefore, needs to be modified. Facts are often described as isolated units which can be judged as right or wrong. However, if the factual knowledge is constituted of both facts, concepts and methods, these may be related to an imagined whole.

We thus suggest that seeking for facts does not have to imply an isolated information search process or a trivial compilation of facts. Searching for facts may form the basis of a deep learning process. Without factual knowledge it is difficult – if not impossible – to develop deep understanding or critical analytical abilities. If specific factual knowledge is disregarded for the benefit of generic, abstract skills, students will hardly learn meaningful information seeking, problem solving or critical thinking. A core finding in our research is that students tend to lose meaningful knowledge content if they search for *type I* facts rather than for understanding a particular issue or topic. This has important consequences for their learning as regards purposeful ways of engaging with information to construct knowledge.

The Second Dimension: Different Ways of Constructing Knowledge

Our findings indicate various features of self-directed learning that are critical for students' possibilities to construct knowledge through this type of work (Limberg *et al.* 2008). These critical features mainly concern four aspects of working with an assignment. Firstly, it seems crucial that the assignment is based in a researchable question, that is, a question that lends itself to open and critical exploration of some issue, and therefore is not limited to factual questions. The questions should not be too complex, nor too abstract, in relation to students' prior knowledge. Likewise, it is significant that the questions are experienced as meaningful by the students. The act of constructing new knowledge via information

seeking and use seems to require the ability to look for parallels and analogies between what is new and what is already familiar.

Secondly, it seems important that specific aspects of information literacy are taken into account in different assignments. Our findings, as well as those of other researchers, indicate that information literacy instruction tends to focus on ways of seeking and finding information sources via various search tools, or on the process of seeking, that is the order of steps or phases of the search process. Other aspects of information activities, such as the assessment of relevance or a critical approach to sources are likely to be disregarded or at least not emphasised as much (cf. Limberg *et al*. 2008; Sundin 2008). Furthermore, when the critical evaluation of sources forms a serious object of teaching it risks sticking to conventional ways of evaluating sources linked to control of the origin and not taking the affordances of new participatory digital tools such as blogs and wikis into account (Francke, Sundin & Limberg 2011). With reference to these findings, it seems essential to develop more specific approaches to teaching the critical evaluation of sources mediated via participatory tools. This might involve tracing the history of entries in Wikipedia articles or identifying the recurring and contrasting perspectives of a controversial issue. The importance of observing particular interests, settings and contexts around information sources or statements should also be taken into consideration in more purposeful teaching (cf. Francke & Sundin 2012).

Thirdly, consistent and regular feed-back from teachers and librarians throughout the task seems to be of vital importance for the quality of students' information seeking and use. It is not sufficient that teaching and feed-back are limited to one lesson on search tools and tips on some sources at the initial phase of a task. Findings indicate that feed-back on both the process and content of the task should be given. It also seems essential that feed-back is given on both information activities and on the gradual development of students' knowledge of the topic or issue under study. Our findings show that the more active the students are in

selecting topics in line with their own interests, the more active educators need to be in guiding the work, through explicit requirements, and clear scaffolding, providing support and challenges to students' work. When students are asked to construct knowledge independently, close interaction between students and educators become a core activity. If teachers become general aides as administrators of teaching, students are offered poor possibilities for knowledge construction (Österlind 2005). Rather, teachers should organise and guide the work to provide the support needed for students to construct meaning from the information found. This is why teachers' control of substance and direction of the work has decisive importance (Alexandersson *et al.* 2007; Limberg *et al.* 2008). Self-directed learning may imply particular difficulties for students in need of special support and scaffolding for learning. These students' work will often result in copying text more or less randomly (Limberg, Alexandersson & Lantz-Andersson 2008).

The fourth aspect was identified in one of our research projects conducted between 2001–2003 (*Learning via the school library*) where we found that students tend to define their work at the computer as "school tasks" and thus adapt to expectations about school work. We were able to identify three groups of students, regardless of age, according to patterns of adaptation: 1) One small group of students who had difficulties in searching and finding any relevant information; 2) One larger group of students who managed to find and compile factual information into simple reports but who did not manage to question or critically evaluate information sources or to transform information into substantial knowledge; 3) The third group of students managed both information seeking and use and gave evidence of quite sophisticated knowledge construction through their independent work. Students in the first group have fewer resources for encountering the digital world and so poorer chances of managing future requirements in education as well as work life. In several articles we have discussed the risk that these students may be left in the shade of the Knowledge Society, and that the rhetoric

around ICT use in school might conceal this problem. (Alexandersson & Limberg 2005; Limberg, Alexandersson & Lantz-Andersson 2008). Alexandersson, Hurtig och Söderlund (2006) claim that students who can only manage the practical manipulation of the new technology will be unable to compete with those who master both the technical skills and abstractions, suggesting that those who know how to manage technology as well as how to seek and use information will also find it easier to make meaning and construct knowledge.

The Third Dimension: New Conditions for the Division of Responsibility and Meaning Making

One of the main results from our projects reflects a clear shift in discourses within school – from teacher-centred to student-centred work – where information technologies and new digital media reinforce this movement. This shift entails new ways of disciplining students; students become participants in a school practice where, through "independent work", they learn to assume responsibility for planning their own work and time – that is, their own learning. Österlind (2005) claims that student-centred learning tends to work as a subtle way of disciplining and "schoolifying" students. We found that students defined their school tasks in ways that were meaningful to them in relation to how they experienced school's expectations; that is, as a pupil you are expected to take responsibility and be busy. However, if teachers and librarians confer too much responsibility on students the outcome may be that activities such as searching for information, sorting, compiling and presenting facts are viewed as more important processes than what students learn about their topics (cf. Lundh 2011). It seems that for students to be successful they are required to master certain implicit pedagogical basic rules, such as being able to accept certain ways of seeking and presenting information. In this situation it cannot be taken for granted that the knowledge content as such is being observed as the main point of the process.

One of the most serious problems that we observed in our research is that the substance of teaching itself – the particular knowledge content – tended to be disregarded by students as well as educators in connection with activities such as independent work, explorative work or students' *research*. For instance, the response from teachers or librarians on *what* students seek and find information about was not at all evident in our studies. As mentioned above, it was not unusual that students experienced their own assigned *research* simply as a school task to be completed. The procedure for doing this was to collect information to be compiled and presented. With such an approach students' activities are not driven by genuine curiosity or a wish to understand something; instead, their ambition is to adapt their efforts to the expectations of school. One example of this was how students would transform their *research* topic, not into a researchable question but into a search term in front of the computer in the library. In this way, the assignment would be guided by topical terms, such as "Titanic","dolphins" or "pirates" and not open to critical questions. Researchable questions might instead be formulated as "Why did the Titanic go down?"; "What is the life environment of dolphins like?"; "What did it mean to be a pirate during the 18th century?" or "What different explanations can I find for 'the wreck of the Titanic', 'the life environments of dolphins' or 'the occupational roles of pirates' at different web sites?". These are questions open to meaningful exploration.

The Fourth Dimension: New Conditions for Communication in Classrooms

It seems obvious that the increasing use of ICT has influenced the patterns of communication in Swedish classrooms. For school to change, the communicative structures of classrooms must change too (cf. Kuhlthau, Caspari & Maniotes 2007). This is why feed-back to students throughout their work can be seen as a prerequisite for learning (cf. Hattie 2009; Shute 2008). However, if feed-back is to contribute to learning it needs to be precise with regard to the various specific features of

school tasks, including aspects of information seeking and use (Sundin, Francke & Limberg 2011).

When students discuss with each other, they often want a comment or confirmation from their teacher before proceeding with their task. As stated above, we found that students experience information seeking as school tasks, and in line with other school tasks, it should be assessed by the teacher. The majority of teachers and librarians express the view that communication contributes to learning and that students should interact in order to help each other and to collectively find solutions. Our findings point to the importance of social interaction, but at the same time, they indicate problems related to the focus of communication, where form tends to rule over content and where the lack of time restricts the possibilities of in-depth or well developed reasoning about the information collected by the students.

According to our findings, a successful information seeking process via the computer is a question of knowing implicit basic rules about how to manage the new technology and also how to participate in the *language game* (Wittgenstein 1953) going on in these student-centred activities in order to manage information seeking as a school task. We may call this an institutionalised practice and this has great significance for students' learning via information seeking in the library or the classroom. Students who do not participate in this language game risk being labelled as low achievers in school. Activities such as *research* via the school library may thus result in limiting educators' views and understandings of students' work, which may be counterproductive. For instance, the term information seeking focuses on searching and finding information, disregarding the *use* of information (Limberg & Folkesson 2006; Sundin 2008). On the basis of all interviews, surveys, observations, field studies and analyses of students' products (documents, presentations, reports) carried out during twelve years' research we conclude that teaching should be less directed at seeking information and at the use of various search tools and technologies and should instead be strongly

directed at aspects of *using* information, with a special emphasis on the critical evaluation of sources and on the construction of meaning from information. Assessment and evaluation of sources may be related to the perspectives offered on a subject or an issue by different sources and to the ways in which different perspectives agree, disagree or may be compared. Different sources may, in this way, be understood as different voices in on-going conversation about the issue of climate change, over-fishing of cod, or reasons for some people to become pirates in the 18th century. Our findings underline the importance of close collaboration and interaction between educators (teachers and librarians) and students during work with student-centred learning tasks. This interaction should be directed at the knowledge content of the task – not, as is often the case, at technicalities, order, and procedures in the work. Moreover, collective interaction in the classroom is of significant importance for the quality of student learning. Learning happens through communicative interaction, which will be further discussed below.

Final Words: A Changing School Discourse Was Shaped

There is no doubt that school underwent significant changes during the last decade. One significant change concerns the increased amount of time devoted to individual student work at the cost of collective experiences in the classroom. A school predominated by teachers teaching, often from the desk, and where the school class constituted the unit of teachers' attention, was replaced by an increasing focus on individual students, thus contributing to 'the individual project'. Work methods became more individualised and the physical space was increasingly shaped to suit individuals. While less time was devoted to collective gatherings, experiences and conversations, time devoted to administration, information and instructions increased. Abilities such as planning your own work, thinking about content and one's own study behaviour and the value of efficient time use have had a strong impact on the work in the majority of classrooms. At the core, this is about discipline of self, where

time planning and use appears as a key issue. External control became weaker, timetables were flexible and students had to decide themselves when to start or end work. In Foucauldian terms (1979) this may be expressed as a development from external to internal disciplining.

This development stands out clearly in our research projects. Is it possible that teachers and librarians take it for granted that the new rules of the game already exist *within* the students as a kind of natural approach to learning, as an inner discipline? The shift in pedagogical practices from teacher-centred teaching to student-centred learning, modelled on work methods similar to those of research and mediated via information technology, is a new form of socialising students through the expectation of increased self-discipline. However, based on their understandings of the task and the school practice in which they participate, what students seem to be doing is to define school tasks in ways that make them meaningful in relation to the discursive practice of school. This implies being active, responsible and disciplined in working with modern technology. Students act according to their assumptions about what is expected of them. Without a cultural competence of schooling they would hardly be able to master complex tasks such as doing *research* via the school library. In spite of the freedom offered by the school library as a space for learning, students are not able to take advantage of this offer. They seem to nourish an established view of the proper way to work in the library and enact activity patterns shaped by the influence of teachers in classrooms and reproduced in and via the school library. The emphasis on "the individual project", students' individual work, strengthened by computer use, contributes to reducing opportunities for collaborative conversations and collective experiences. It can be claimed that the educational project of school has been radically changed by this shift.

All education is in some respect a type of upbringing connected to how value systems such as democracy may be understood, described and enacted. Societal change influences our value systems and views of what education should be about. This will have consequences for students'

information seeking and learning. What knowledge is being constructed when students seek, use and compile information via the Internet? In the wake of implementing new information technologies in Swedish schools there is talk about a fourth basic skill; the ability to manage the medial flow. This implies being able to see through values, attitudes, and life styles; and to be able to filter information overload. We suggest that abilities to critically evaluate sources may be viewed as aspects of foundational values, ethics, norms, and morals. If students do not develop such abilities and approaches there is a risk that they will not be educated to embrace curricular goals such as "a social sense of justice, generosity of spirit, tolerance, and responsibility" (Lpo 94, p. 3). One of school's most important duties is to offer knowledge and abilities that help students to take a stance on issues emerging in a society characterised by mutual dependence and multiple cultures. This requires a language and the ability to express and share one's understandings and perspectives with others. During the first decade of the 21st century, when our research was conducted, it was not obvious that increased computer use contributed to this.

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Notes

1. This article is a revised and rewritten English version of a chapter in a Swedish edited book *Informationskompetenser: om lärande i informationspraktiker och informationssökning i lärandepraktiker* [Information Literacies: On Learning in Information Practices and Information Seeking in Learning Practices]. Eds. J. Hedman & A. Lundh. Stockholm, Carlssons förlag, 2009. pp. 85–107.
2. When written in italics the term *research* in this article signifies the type of student centred learning activities going on in schools and which is the term used in the school context for this type of work.
3. The national curriculum in force during the years of our research was applied since 1994. It has recently been changed, but these changes are not considered in the studies reported here.

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