The challenges of the first research paper –
observing students and the teacher in the
secondary school classroom

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Introduction

Assignments requiring independent information seeking and knowledge construction are common in schools today. The student is expected to select a topic of interest or focus on a given topic, search information through different information channels, use information sources found and create a report or a presentation. In addition to learning about the topic, self-governed work on the assignment is seen as an approach to developing skills and practices related to information seeking, information use and independent learning even though this is not always explicitly stated. (See e.g. Limberg 1999; Smith & Hepworth 2007; Wallace, Kupperman, Krajcik & Soloway 2000.) The Internet has become the dominating information environment for inquiry-based learning (Kuiper, Volman & Tervel 2005; Wallace 2004).

The goal of information literacy (IL) education embedded in the school’s curriculum goes beyond the school. In formal education, information literacy is seen as essential for learning to learn and for lifelong learning (Bawden 2001; ANZIIL 2004; ALA 2007). Studies on embedded information literacy education in schools have shown, however, that its goals are difficult to achieve. Some of the reasons for problems are:

- Students often experience information seeking and use for learning as a complex task. They may feel they lack the skills required and hence do not engage with the process. (Smith & Hepworth 2007.)
- Most students tend to simplify a learning task perceived as complex by making a minimum effort in information seeking and the assessment of sources (Shenton & Dixon 2004; Limberg 1999, 2007).
- They use only one or two sources and copy rather than formulate their own texts. The task of inquiry is reduced to a task of collecting and compiling a set of facts about the topic of the assignment (Alexandersson & Limberg 2003).
Imposed learning tasks might demotivate students and affect their whole information behaviour (Gross 1995; 2004).

Often students do not find the subjects they are studying interesting (Smith & Hepworth 2007).

Research assignments seldom turn into relevant and researchable questions (Alexandersson & Limberg 2003).

Researchers see a very fundamental reason for the above mentioned problems. In traditional teacher-centred schooling, the teacher, textbooks and materials given by the teacher were basically “authorized” sources of information. It has been argued that the discursive practice of school shapes students’ view of information seeking and learning into fact-finding (in the sources given). The student tends to understand that the goal is to find and reproduce right answers and that this is what the assignments are about. The traditional way of understanding information seeking and learning seems to overtake attempts to adopt inquiry-based approaches in teaching. (Harada & Yoshina 2004, Kuhlthau, Maniotes & Caspari 2007; Kuiper et al. 2005; Limberg and Folkesson 2006; Limberg, Alexandersson, Lantz-Andersson & Folkesson 2008.)

A joint conclusion from several studies is that students need more support in the classroom to engage in inquiry-based learning, information seeking and knowledge construction. A key to genuine learner-centred inquiry in schooling is that the role of the teacher changes into a ‘fellow creator of knowledge’. (Alexandersson & Limberg 2003; Chu, Chow, Tse & Kuhlthau 2008; Li & Lim 2008.) Although inquiry-based learning is commonly applied in schools few teachers seem to have explicit strategies for supporting their students to cope with the problems of information seeking and use. While revealing the problems and to some extent potential pedagogical strategies to solve the problems, past research has seldom directly observed what really happens in the classroom.

The expressed requirements for the new role of the teacher motivate the study of interactions that take place in the classroom between the teacher and students and between students (See e.g. Kuiper et al. 2005): What kinds of problems do students experience? Where do they need help? What kinds of strategies does the teacher use in supporting students? How are the interactions related to learning experiences?

This chapter presents findings from a field study in a secondary school. We focus on communicative interactions between the students and the teacher in the classroom. We expect that the analysis of the students’ requests for help (problem expressions) and the teacher’s responses to them (support expressions) can increase
our understanding of the challenges faced by students and of the role of a teacher as a facilitator in inquiry-based learning. We will also look at how the contents of the communicative interactions may relate to learning experiences reported by the students.

**Theoretical framework**

We use the terms “learning task” and “learning assignment” as synonyms meaning a teacher-designed but learner-centred teaching and learning activity focusing on a specific area of knowledge (See Tanni & Sormunen 2008). The aim of the learning task is to help the learner achieve specified learning outcomes. However, Limberg (2007) found that each student experiences the task given by the teacher differently. An assignment introduced by the teacher is actually a cluster of assignment variants as perceived by students.

Kuhlthau et al. (2007, p. 79) define information literacy as the ability to locate, evaluate and use information. However, they do not see information literacy as a detached, generic skill but give a constructivist interpretation for it by integrating its goals and contents into self-governing learning competences. Similarly, Limberg et al. (2008) emphasize that the abilities to seek and use information in purposeful ways are interwoven with the task, situation and context in which information seeking practices are embedded. We prefer this view on information literacy the stance taken by Kuhlthau and Limberg because it encourages the study of information literacy and IL instruction embedded in the mainstream of instruction.

Inquiry-based learning refers to a broad set of approaches applying the idea that learners should learn as scientists do research. In a History class, for example, the student should “do history” as a historian (Li & Lim 2008). Students are active constructors of knowledge and the teacher is a facilitator of learning. The teacher sets the goals and the general content frame for learning but students have to specify questions, look for information, and search for answers (Chu et al. 2008). In traditional learning, the teacher decides the contents to be studied on the basis of the curriculum, specifies the questions for the students to answer and assesses what the students have learnt about the intended learning contents.

Earlier we argued that the first research paper is a demanding (i.e. complex) task for students. Byström and Järvelin (1995) have defined that the complexity of a task is associated with the uncertainty perceived by the actor about the information requirements, process and outcomes of the task which lies ahead. All three criteria for complexity seem to hold good in our case. In a genuine inquiry-
Based learning task the student cannot specify in advance the information that is needed in learning or what the explicit outcomes of the inquiry will be. The predictability of the work process depends on how familiar the student is with the practices of inquiry-based learning. In our case, the students were novices in inquiry-based learning and obviously perceived its procedure as complex.

Because of the complexity of an inquiry-based learning task, students with little experience of independent learning need various kinds of scaffolds (i.e., support structures and activities organized by the teacher) to complete the task successfully. Written prompts to remind the learner of some key aspects of the assignment, and argumentation templates to organize ideas are examples of fixed scaffolds. The teacher’s interventions in the process by asking questions (e.g. why are you doing this?) or by modelling procedural options (e.g. the teacher shows a procedure, the student observes and tries to apply it) are examples of adaptive scaffolds (Li & Lim 2008). The teacher’s communicative interactions with the students belong to the class of adaptive scaffolds. The teacher can use planned strategies for responding to requests for help, but what specific issues and problems will be encountered is hard to predict in advance. Information literacy models such as the ISP model by Kuhlthau (2004) and PLUS model by Herring (2006) can be used as scaffolds in the embedded IL instruction.

Kuhlthau (2004) has extensively studied information seeking in the context of inquiry-based learning assignments. One of her major findings is that uncertainty is inherently associated with all construction processes such as information seeking and learning. A key challenge for information literacy education is to help students cope with their uncertainty. (Kuhlthau 2004, 89-92). Based on Vygotsky, Kuhlthau introduced the notion of “zone of intervention” characterizing those situations where the teacher can help the student learn. The zone of intervention is a situation “…in which the student can do with advice and assistance what he or she cannot do alone or can do only with great difficulty”. Intervention is effective in the zone but may be ineffective or even harmful outside the zone. (Kuhlthau 2004, 128-129.)

For effective interaction, the teacher needs to identify the zone of intervention but this may not always be easy. One indicator of such a zone is the learner’s increasing uncertainty. For example, the student often gets confused and anxious when she encounters inconsistent and conflicting information. This is typical when the student’s personal focus on the assignment is still under construction and the criteria for identifying and selecting information are not yet fully developed. Thus, this explorative stage is one potential zone of intervention. There the teacher can
help the student learn to cope with the uncertainty of the inquiry process (Kuhlthau 2004, 204-205, Kuhlthau et al 2007, 139-140).

The theoretical ideas described above lend support to the importance of studying communicative interaction in the classroom. Students’ requests for help indicate zones of intervention for the teacher. The teacher can also “read signs” of students getting stuck and offer self-initiated support. Analyzing students’ expressions for help provides more in-depth knowledge about the types of issues they are struggling with. These issues might be closely related to the contents of learning. Analyzing support expressions also helps in identifying the strategies that the teacher and fellow students tend to use in interventions and how these strategies support the goals of inquiry-based learning and embedded information literacy instruction.

**Research questions and research design**

The goal of this research was to gain an understanding of students’ experiences of demanding learning tasks. A secondary school teacher asked us to study what happens in her class of eight-grade students working on a research paper on cultural geography. The learning task was demanding for the young students because it was their first assignment requiring independent information seeking and research work. The study adopted a holistic and explorative approach and collected a rich data set including observations, surveys, interviews and research papers. We focused on the following research questions:

1. How do students work on and proceed with their first research paper?
2. What kinds of challenges and problems do students face during the research paper process, especially in information seeking and use?
3. How do the teacher and fellow students support students facing problems in their learning task?
4. Are expressed problems related to learning experiences?

**Data and methods**

The data were collected in spring 2007 in a class of fourteen-year-old students (N=17) at a secondary school in Southern Finland. The students were working on a research paper for a course on European cultural geography. This was the largest research paper they had done so far and primarily it was an individual effort. The course lasted nine weeks. The idea was to make a virtual Interrail trip to three
European countries. The students chose three countries and planned “an ecologically friendly” interrail route between them.

The students were to work on three themes in this order: (1) nature, (2) agriculture and food, (3) culture. The themes consisted of subthemes which were listed in the written assignment given by the teacher. Each theme was studied in one country and the substudies were brought together at the end. The paper was expected to be in the form of a research report including logical structure, careful citing of the sources used and listing of the references.

Data gathering
We used various data collection and analysis methods to create a rich and interpretive description of the students’ working on the assignment. (See Cohen, Manion & Morrison 2004; Pickard 2007.) A pilot study was first conducted to test data collection methods for the main study in an eight-grade class of 15 students. We interviewed the teacher about the course, observed classes and tested questionnaires adapted from the SLIM-toolkit (Kuhlthau et al. 2007, 127-130). Based on the experiences gained from the pilot study, we decided to observe the classes more than previously planned. The students’ answers in the questionnaires were often quite short and observation provided valuable information for understanding the students’ experiences and the flow of their research paper project.

In the main study we followed the nine-week course from its beginning to its end. The students filled in three questionnaires developed in the pilot study. The researcher observed five of the two-hour meetings non-participantly in the school’s PC room. The completed research papers and the students’ self-assessments of them were gathered. Two groups of three students were interviewed at the end of the course about different aspects of their experiences. The interviews were tape-recorded.

In this article we mainly focus on the observation data. The questionnaires, interviews, completed research papers and the assessments thereof provided a background for understanding the observation results. The researcher recorded the students’ problem expressions and the teacher’s and fellow students’ support expressions by writing them down manually without personifying the students. She also wrote down the topic of the class and other interesting data, for example forthcoming deadlines. The students got used to the researcher’s attendance in the classroom quickly. They did not know that the researcher was observing their problem expressions and information searching. The intentness of the teacher's and
students' working gave an impression that the researcher’s attendance in the classes did not substantially affect the students’ information behaviour.

The data cover expressed problems and support. One limitation of the data is that the problems which the students were unable to articulate were not recognised. Another limitation might be that the data may be biased by more active and talkative students. Observations were recorded by manual note making. This was possible since most of the students were working quietly and usually only a few students at a time were asking questions. The observer was not able to register all problem and support expressions, but the extensive set of notes made in five classes is assumed to reveal and characterize the major patterns in the communicative interactions relevant for this study.

**Data analysis**

The analysis of the field notes was started by defining the unit of analysis for the observations. For the problem expressions, one expression from one person directed at one problem content at one moment of time was defined as the unit of analysis. One expression could consist of several sentences. If the student’s request for help consisted of several problem topics, each was coded as a different problem expression. For the support expressions, one expression from one person at one moment of time concerning support of certain nature was coded as one expression (See Table 1 for examples). If the person’s support consisted of several support topics, each was coded as a different expression. Several support expressions from different persons could be related to one problem expression. Support expressions also occurred unprompted and were not always linked to problem expressions.

After the problem and support expression units were recognized from the data, they were classified inductively under tentative categories using the open coding method (Pickard 2007, 234). The coding of the problem expressions (N=163) was based on the topic of the problems expressed and the iterative process yielded 17 stable problem categories. The support expressions (N=234) were coded according to the role adopted by the supporter. 16 support categories were identified. After the coding, the categories were tested and compared. We made sure the categories were mutually exclusive and exhaustive (See Bryman 2008, 288).

To further condense the data, the 17 problem categories were clustered into five main categories and the 16 support categories into four main categories. Descriptive statistical analysis with frequency tables was applied separately to the problem expression and support expression data. Pearson Chi-square dependency tests between problem and support expression categories were carried out.
The number of support expressions (N=234) does not equal the number of problem expressions (N=163). This is because some support interactions were initiated without an explicit request for help (i.e. unprompted). Further, some requests for help triggered more than one support expression. On the other hand, 42% of the students’ problem expressions did not get support. The number reflects the interaction in the busy classroom. The teacher or fellow students were not able to immediately assist all students asking for help. During the time of waiting, the students were able to solve some problems by themselves or the problem situation went by. Sometimes the students “thought aloud” about their problems or challenges and these actions were also classified as problem expressions.

Eight illustrative examples of problem-support interactions are presented in Table 1. Each interaction begins with a request for help (problem) and continues with aid given by the teacher or a fellow student (support). There are also examples of how the problem and support expressions were classified into problem and support categories.

The inductive content analysis was applied to the completed research papers, questionnaires and interviews. The descriptive statistics were produced from the students’ self-assessment forms concerning the completed research papers.

<table>
<thead>
<tr>
<th>ID of problem-support expression pair</th>
<th>Speaker</th>
<th>Transcribed interaction</th>
<th>Problem/Support</th>
<th>Category of problem/support</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 student student</td>
<td>Where could I find this? [piece of information]</td>
<td>problem support</td>
<td>giving hints for information searching giving the solution</td>
<td></td>
</tr>
<tr>
<td>7 student student</td>
<td>The homework?</td>
<td>problem support</td>
<td>assignment giving the solution / answer</td>
<td></td>
</tr>
<tr>
<td>15 student student</td>
<td>What is Denmark [Tanska] in English? You don’t have to write down the country, just the town</td>
<td>problem support</td>
<td>language advising</td>
<td></td>
</tr>
<tr>
<td>24 student teacher</td>
<td>Teacher, is this [image] good enough? Well, it doesn’t tell very much... maybe you could take another [image]</td>
<td>problem support</td>
<td>assessment of work giving feedback making a suggestion</td>
<td></td>
</tr>
<tr>
<td>27 student student</td>
<td>Do you also have Madrid [in this theme]? Almost everyone has</td>
<td>problem support</td>
<td>choosing route and countries giving the solution</td>
<td></td>
</tr>
<tr>
<td>29 student student</td>
<td>Where can I find Wikipedia, what is the address? Put it in Google!</td>
<td>problem support</td>
<td>information searching advising</td>
<td></td>
</tr>
<tr>
<td>37 student student</td>
<td>What do I have to do? Why don’t you put it this way?... [makes the diagram smaller] ...ok, now it’s good</td>
<td>problem support</td>
<td>word and image processing / use of programs making a suggestion carrying out the task on behalf of student</td>
<td></td>
</tr>
<tr>
<td>51 student teacher</td>
<td>Hey, there’s no place-names in this map! [Teacher and student work together to solve the problem] You can also write down a description next to the map</td>
<td>problem support</td>
<td>assessment of sources working in collaboration with student making a suggestion</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Examples of the students’ problem expressions and the teacher’s and fellow students’ support expressions.

Results

Goals and instructional design of the project.
In the pilot interview the teacher identified instructional designs for the course. European cultural geography was defined as the main learning goal of the course. In addition to this, the teacher wanted the students to practice how to:

1. plan and conduct a large assignment;
2. schedule and carry out their work;
3. seek information in the internet and through library and use information independently;
4. use computer and its software for learning purposes;
5. learn how to create and analyse diagrams and
6. manage file transfers between the school and home.

The students were expected to work individually in the school’s PC room and at home. They were guided to seek information on their own topic areas and write their research papers. The teacher stated in the interview that she adopted the role of an advisor assisting students in different kinds of problem situations.

**Flow of the process**

During the first two weeks of the course the students chose their target countries and planned their interrail route. According to the analysis of the completed research reports, the selection of target countries was based on the students’ personal interests or hobbies, travel experiences or previous knowledge. Students in the study believed that many of their peers chose countries they had previous knowledge about and on which information could be found easily (See Rantala in this volume for similar findings.). For example, some students chose France for the *agriculture and food* theme as they were familiar with the country’s gastronomy.

After the planning phase the students carried out their study of the three themes (*nature; agriculture and food; culture*) one by one. They sought information and images on the themes and wrote a section of text on each theme. The first theme *nature* was the broadest and most difficult and took three weeks to complete. After the first theme the students filled in self- and peer-assessment forms for the first part of the report and the teacher also gave them her assessment. From these assessments the students got feedback on the work done, had an opportunity to improve their research papers and got advice for the upcoming themes. After the first theme the students took an exam as a part of the course.

For the remaining themes *agriculture and food; and culture* the schedule was busy and the themes were discussed only in two teacher-led classes. The *culture* theme related to hobbies was easy for students. Working more independently and mainly at home increased towards the end of the course. During the last week of the course the students finalized their research papers by compiling the list of
references, marking citations in the text, as well as adding the cover page and illustrations. At the end, students made self- and peer-assessments of their research papers and returned the papers to the teacher for the final assessment.

Challenges and problems faced by students
The students asked the teacher and their peers for help on different issues during the PC room classes. The main problem categories were *information seeking and use of sources; work process; end product; geography content; and technical problems.*

<table>
<thead>
<tr>
<th>Problem categories</th>
<th>Number of expressions</th>
<th>% Problem category</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFORMATION SEEKING AND USE OF SOURCES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A use of sources</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>B information searching</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>C evaluation of sources</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>53</td>
<td>33%</td>
</tr>
<tr>
<td>WORK PROCESS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A scheduling</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>B work plan</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>C assignment</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>D frustration</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>34</td>
<td>21%</td>
</tr>
<tr>
<td>END PRODUCT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A assessment of work</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>B headlining and naming sections</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>C language</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>26</td>
<td>16%</td>
</tr>
<tr>
<td>GEOGRAPHY CONTENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A content of themes</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>B choosing route and countries</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>C geographic content</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>25</td>
<td>15%</td>
</tr>
<tr>
<td>TECHNICAL PROBLEMS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A word and image processing / use of programs</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>B file downloading</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>C managing term paper file</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>D printing and scanning</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>25</td>
<td>15%</td>
</tr>
</tbody>
</table>

| Total                                        | 163                   | 100%               |

Table 2. Problems expressed by the students in five PC room classes.

As can be seen from Table 2, a large share (33%) of the expressed problems were in the area of *information seeking and use of sources.* The problems in this category branched into three subcategories: information searching, evaluation of sources and use of sources. These problems were strongly associated with the use of the Internet. Finding suitable search terms and desired sources, especially pictures and maps, was difficult for the students. The descriptions assigned to graphical materials were mostly in English and brought additional difficulties in formulating searches.
Challenges continued after students had found some sources: altogether 33 problem expressions were directed at the use and evaluation of sources. Navigating through web pages and finding the desired information was difficult. The evaluation of the open Web sources was often cognitively too challenging since students were not familiar with the terminology or argumentation used. For example, one student found a research paper written by a university student and was not able to utilize the information because of its complexity. Students sometimes made illogical decisions due to ignoring or misinterpreting the context of information. One student, for example, picked an image of an African steppe for a section about Spanish steppes.

The problems concerning the work process (21%) were related to scheduling, the content of the assignment, meeting the deadlines and general frustration about the assignment. The learning task was a large project for eight-grade students and demanded a lot of independent work. Frustration was caused by the uncertainty concerning the process. The students did not always know what to do next and asked the teacher and fellow students for advice. Some students experienced problems in meeting the deadlines and were often in a hurry. Independent work and information seeking was time-consuming.

The problem expressions related to the end product (16%) were focused on whether the completed version of the research paper was in line with the requirements of the assignment. The language and the subheadings to be used in the completed paper also caused concerns. Some students were not sure how to construct subheadings for finished sections and consulted the teacher or their fellow students for advice. They wanted to make sure that their work fulfilled the assignment’s requirements and that they had worked “correctly”.

The questions on geography content (15%) varied a lot in their extent and focus. Students wanted, for example, to know which target countries other students had chosen and wanted to compare their routes. Some questions were short and directed at geographical terminology, but some referred to broader issues. The students had trouble in differentiating between the three themes and sometimes were uncertain about which theme they were actually studying. Their insufficient knowledge of geography obviously affected the occurrence of problems classified to other categories, for example, success in choosing search terms and using geography sources.

The technical problems (15%) were especially related to word and image processing and use of computer programs. File downloading, printing and scanning also caused problems. The spreadsheet program which the students used for
climate diagrams and pasting images found on the web also posed challenges. Most students used a word processing program and only few wrote their papers by hand.

In their questionnaire answers and research papers the students reported about similar problems than in the observation data, but not in the same detail and/or to the same extent. Information seeking was mentioned as a challenge in most questionnaires. In the reflection parts of the research papers, “information seeking” was often regarded as problematic. Students mentioned it as a broad and undefined concept without analysing its challenging aspects more precisely. Other problems mentioned were related to drawing diagrams, lack of time and finding one’s own skills.

A surprising finding was that information seeking and use, work procedures, reporting and technical problems covered 85% of the problem expressions. Geography content was one of the smallest categories with its 15% proposion of expressions. It seems that students who are beginners in inquiry-based assignments have many basic practices to learn and at least in this case encountered fewer problems with the subject content of the course. A competing explanation is that instrumental activities "stole the show" from the activity of learning geographical contents.

**Support given by the teacher and fellow students**

Support expressions by the teacher and fellow students (N=234) were coded into 16 basic categories which were then further grouped under four main support categories (See Table 3). The main categories are *expert support; ideas and encouragement; collaboration* and *controlling support.*
The largest support categories were expert support (39% of support expressions) and ideas and encouragement (38%). These categories were quite different from each other. Expert support was interaction in which the supporter advised the student intensively and took the role of an informed authority (an expert). The student asking for help had a passive role in solving the problem. The supporter gave the solution to the student, and directed them phase by phase, or assessed the situation and gave detailed instruction on how to improve the work. In the ideas and encouragement category the supporter gave the student different ideas or hints for working and information seeking or encouraged the student to go on. After the interaction, the student continued the task at hand according to the supporter’s advice. The student then tried to resolve the problem with the help of the suggested alternatives.

The remaining two categories were collaboration (14%) and controlling support (9%). In collaboration the student and supporter resolved the problems together. The student already had knowledge or opinions about the task at hand so that they could discuss it and solve the problems together with the supporter. In the controlling support the supporter helped the student keep the process on track. The supporter reminded the student of deadlines, made sure the student had understood the task or saved the research report file.
A general observation was that the teacher was overloaded with various requests for help and finding solutions to them. The students needed support in both geography substance and work procedures and practices, such as technical instruments, scheduling and information searching. As reported earlier, 42% of requests for help did not receive explicit response.

The help provided by the teacher and by the fellow students was different. The teacher’s help covered about 80% of all support expressions. In the categories ideas and encouragement and controlling support the amount of student support was very small, only 10-12%. The students gave each other advice and solutions (expert support), discussed with each other and worked together to solve problems (collaboration). On a few occasions, the students gave hints or controlled each other’s working.

**Interaction in the classroom**

The cross-tabulation of expressed problems and support gives us a view of potential relationships between problem and support categories (See Table 4). The distributions of the support categories across the problem categories reveal some tendencies in the data. The correlations between the problem and support categories were not statistically significant, and the results presented below are only indicative and descriptive.

<table>
<thead>
<tr>
<th>Problem categories</th>
<th>Information seeking and use of sources</th>
<th>Work Process</th>
<th>End product</th>
<th>Geography content</th>
<th>Technical problems</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert support</td>
<td>42%</td>
<td>52%</td>
<td>48%</td>
<td>50%</td>
<td>39%</td>
<td>46%</td>
</tr>
<tr>
<td>Ideas and encouragement</td>
<td>39%</td>
<td>33%</td>
<td>45%</td>
<td>13%</td>
<td>30%</td>
<td>35%</td>
</tr>
<tr>
<td>Collaboration</td>
<td>18%</td>
<td>14%</td>
<td>7%</td>
<td>38%</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4. Problem and support expressions.

*Expert support* was distributed evenly across the problem categories. With the other categories, variance was greater. *Ideas and encouragement* were especially used to support *end product* problems (45%). For example, the teacher offered encouragement when assessing students’ work and discussed issues related to subheadings and language. The portion of *ideas and encouragement* was low with problems related to *geography content* (13%). *Collaboration* was frequently used in solving *technical problems* and discussing issues of *geography*. With the
problems concerning the end product, collaboration was rarely used (7%). Controlling support was initiated by the teacher and was therefore not included in the cross-tabulation.

**Students’ learning goals and learning experiences**

Nearly all students wrote about their learning goals in the introductory section of their research papers. Only eight students reflected on how they had achieved their goals, but all except two students described their learning experiences in general. All these reflection tasks were set by the teacher.

Three students wrote about their goals in detail and mentioned specific and personal goals. Eight students set independent working skills such as information seeking and managing study work and scheduling as their learning goals. Six students wanted to augment their geography knowledge and utilize this knowledge in practice, for example when planning a trip abroad. Two students had strategic goals: they wanted to achieve a certain score.

Most of the eight students who reflected on achieving their learning goals were pleased with their results. The answers on achieving the goals of the assignment indicate that students tend to see the goals in a pragmatic manner:

My goal was to do this piece of work well and in time, and I managed to do this.

I executed my goals so that I managed to make my paper more than 10 pages in length and, in my opinion, worth a good grade.

For the research papers, the teacher asked the students to write a brief summary on what they had learnt on the course. Nine students mentioned information seeking and use skills. Examples of students’ comments concerning these skills were:

I can search information independently and use the right search terms.

To search information from new places.

I’ve become better in searching information on computer.

Aspects concerning the work process were mentioned eight times. These aspects were for example scheduling and making and following the work plan. Students described these skills as follows:

It’s useful to follow the work plan and work accordingly.

Not to leave things to the last opportunity.
Four students mentioned having learnt technical skills, i.e. creating diagrams and word and image processing. Examples of students’ comments on such skills included:

Word processing and putting the images in right places.

How to draw a weather diagram.

Learning experiences concerning geography issues were mentioned only three times. Students learnt new things about their target countries and about Europe. The third questionnaire at the end of the course also included questions on learning experiences. The answers in the questionnaires were very short and some students did not respond. In the research papers, the texts describing learning experiences were longer suggesting that the role of the expected reader of the text strongly affected the students’ reporting behaviour.

Self-assessments of completed research papers
At the end of the course, students assessed their own research papers. The assessment was based on a teacher-planned assessment form consisting of ten criteria. For each criterion, the student was asked to mark a grade between 4 (poor) and 10 (excellent). We present an analysis of the self-assessments here, because they are related to and extend our understanding of the students’ learning experiences. A high grade given by a student indicates a self-perception of making progress in or mastering the area specified by the criterion. The average grades for each criterion are presented in Table 5.

<table>
<thead>
<tr>
<th>Quality and quantity of content</th>
<th>Use of geography concepts</th>
<th>Maps</th>
<th>Images</th>
<th>Diagrams and statistics</th>
<th>Choice of topic</th>
<th>Appearance</th>
<th>Language</th>
<th>References</th>
<th>Readability and intelligibility</th>
<th>Overall grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-assessment</td>
<td>7.1</td>
<td>7.5</td>
<td>6.3</td>
<td>6.6</td>
<td>7.5</td>
<td>7.8</td>
<td>8.5</td>
<td>7.2</td>
<td>7.6</td>
<td>8.4</td>
</tr>
</tbody>
</table>

Table 5. The students’ self-assessments on the completed research papers.

The students gave their research papers an average overall grade of 8.4. The overall grade was higher than the grades for any individual criterion except language (of the report). The overall grade was obviously not based on or balancing the set of ten assessment criteria. It might indicate that the students recognized the value of their effort but were not able to articulate their merits in the specified areas.

The quality and quantity of content (average 7.1), use of geography concepts (7.5) and choice of topic (7.5) are closely related to geography issues and received
medium grades. The lowest grades were given for maps (6.3), images (6.6), and diagrams and statistics (6.0) where students combined geography knowledge to the use of computer tools (spreadsheet or image processing programs) in order to include special representations in their reports. The technical or aesthetic features of reporting: appearance (7.8), language (8.5) and readability and intelligibility (7.6) were marked by the highest grades.

**Summary of the findings**
The group of seventeen secondary school students in our study were experiencing their first inquiry-based assignment. The learning task was complex for the students since they had no previous experience with inquiry-based learning tasks, writing a research report or searching information for a learning task. The students’ work on cultural geography was divided into three themes which they completed one by one. For each theme the students sought information and images and authored a section for the research paper. The students self-assessed their work after the first theme and at the end of the course.

The complexity of the learning task can be seen in the distribution of the problems faced by the students. Information seeking and use of sources, work process, end-product and technical problems covered 85% of the problem expressions observed in the classroom. Only 15% of the problems were about geography, the content of learning. The students experienced difficulties with the special features, procedures and requirements of the inquiry-based assignment.

The most common support categories were expert support and ideas and encouragement. In the expert support category the student was aided with direct instructions or the problem was even solved on his or hers behalf. In the ideas and encouragement category the supporter gave the student ideas and encouraged them, and after the interaction the student tried to solve the problem independently based on the alternatives given. The application of these support strategies instead of collaboration was partially related to time restrictions. The teacher wanted to keep all students on schedule and share her time fairly between the students. Both expert support and ideas and encouragement are faster interaction strategies than collaboration.

Most students were able to reflect on their learning goals and experiences but at a general level only. It seems that they more or less mirrored rather than elaborated the goals and learning contents emphasized by the teacher. The personally formulated goals were mainly associated with strategic learning goals (achieving a high grade, composing a long enough paper). Cultural geography got little attention as learning content.
The students’ self-assessments of their research reports indicate that they perceived themselves as making some progress as authors of research reports. Applying computer tools to create visual representations was maybe not an encouraging experience on this course.

**Discussion**

The course studied exhibited several of the features of an inquiry-based learning assignment. The teacher set the general goals and themes for the project but the students chose their target countries, sought information independently and made their own work plan in order to achieve their learning goals. The teacher positioned herself as a facilitator of learning by using four main support strategies: expert support, ideas and encouragement, collaboration, and controlling support. The students were responsible for seeking and using information, constructing knowledge and authoring their research reports. They were also guided to reflect on their learning and assess their progress at different stages of the process. Two aspects of the assignment were not in line with typical inquiry-based learning processes. Students were working as individuals on their reports and the focus was on open-ended themes rather than on specified research problems. (See Chu et al. 2008, Kuhlthau et al. 2007.)

Limberg et al. (2008) summarize the findings of several studies conducted on information seeking and learning in Swedish schools (Alexandersson & Limberg 2003; Limberg 1999; Limberg & Folkesson 2006). They argue that the most common patterns in the interaction between students and pedagogues (i.e. teachers and school librarians) and students themselves are mainly “…directed at pressing the right keys, finding the right pages or web portals, and doing various parts of the assignment in the right order for accomplishing the task” (Limberg 2008, 85). Thus the interactions tend to focus on and support only the learning of low level information literacy skills.

It was evident that similar patterns of communicative interactions focusing on lower level skills and learning goals were dominating this classroom. Most requests for help dealt with basic procedures such as selecting query terms, planning and organizing one’s work, using text and image processing programs, and editing the report. The analysis of expressed problems reveals that some students also discussed higher level aspects of information literacy such as the evaluation and use of information. However, they did not articulate any learning experiences related to the higher level aspects of IL.
In our case study, the teacher set explicit goals to practice the students’ skills in lower level aspects of inquiry. In the practice of the secondary school, the teacher saw this as a realistic starting point. Here we can see the difference between the teacher and Limberg et al. (2008) emphasizing high level aspects of IL. However, these two viewpoints are not exclusively contradictory. Our teacher works in a lower secondary school while Limberg’s group has mainly studied upper secondary schools. The critical question is: Do learning goals evolve towards higher level aspects as students progress through the school system? This is not likely in our case study school (similar to most schools) since IL instruction is not embedded in the school’s curriculum. It remains as an endeavour of some enthusiastic teachers.

Although we could accept the challenge of the starting point in IL instruction in secondary schools it is relevant to discuss instructional designs that could support learning higher level IL skills. Limberg et al (2008) found examples of classrooms (mainly at the high school level) where students obviously learnt higher level IL practices and achieved meaningful learning outcomes. The teacher’s support seemed to be critical in three major activities: (1) formulation of research questions, (2) critical evaluation of information and (3) understanding and negotiating learning goals. We discuss each activity below.

Limberg and the others found that there is a positive relationship between the quality of research questions, successful information seeking patterns and the gradual development of the student’s understanding of the subject studied (Limberg et al. 2008). Some of the teachers had developed good practices to support students’ elaboration of their research questions:

1. Enough time (several hours) was devoted to discussing and developing research questions.
2. The teacher gave feedback to guide the students in formulating genuine problem-based questions, which are not too broad or too narrow.
3. The teacher was paying attention to the students’ own interests in the topic.
4. The students were encouraged to browse information to find different perspectives on their topic.
5. Interaction between the students was enhanced by working in small groups to share experiences and ideas, to brainstorm, and to compare different views.

In our study, a limited amount of time and attention was allotted for the development of the students’ research questions since there were so many new procedures for them to learn during the first few weeks of study (item 1 above). Further, it is more honest to talk about broad research themes which the reports
were to discuss rather than specific research questions to be answered. The three themes were given by the teacher and the students were free to choose the country to be studied under each theme. The teacher helped the students focus their themes (item 2), encouraged them to find a personal viewpoint on the themes (item 3), and suggested the study of different information sources (item 4). A major limitation observed was that small group activities were not exploited in instruction to support the sharing of experiences, ideas and views between students (item 5). Collaboration between students was not rare but it was not formally supported to take full advantage of it.

The second finding of Limberg and her colleagues was that the critical evaluation of information and information sources is problematic for students. Students face serious difficulties in capturing the meaning of, and applying general guidelines for the evaluation of information sources. A step towards a solution was that some teachers tried to reduce the difficulty by providing students with concrete solutions. However, appropriate tutoring in the evaluation of information requires interaction at the level of information content and this was seldom possible for teachers due to time limits and requirements for subject expertise. This area of interaction is very challenging for the teacher. (Limberg et al. 2008.) Kuhlthau et al. (2007) suggest that teachers should work more in teams to increase the possibility that domain specific support can be offered.

In our classroom, the theme-oriented rather than question-oriented assignment did not challenge the students to critically evaluate information sources. In theme-oriented assignments the content of the research report can draw on “safe” and consistent sources. Keeping the assignment theme-oriented might be appropriate for the first research paper but it does not adequately support the learning goals for the critical evaluation of information. However, not all theme-based assignments are weak in this respect. Mäkitalo, Jacobsson and Seljö (2009) describe a special type of assignment, defined by them as the socioscientific problem, which aims to expose a group of learners to competing and contradicting sources of information and activate the collaborative learning of critical assessment practices. For example, Limberg (1999) used the debate on Sweden’s EU membership as a topic for an assignment to challenge the students to assess information sources critically.

The third finding by Limberg et al. was that the teacher and the students tend to understand the goals of assignments differently. They argue that meaningful learning requires that the teacher be active and explicit in negotiating the learning goals with the students so that they are aware of, and committed to them. Furthermore, both the teacher and the students should focus on the contents of
learning. This approach seems to promote both the learning of subject matter and critical approaches to information selection and use. (Limberg et al. 2008).

In our study, the teacher used self, peer, and teacher assessments during and at the end of the assignment to activate the students’ awareness of the learning goals. The assessment was well integrated into the assignment process and most students seemed to recognize many of the goals. The other requirement was that both the teacher and the students should focus on the contents of learning in order to achieve higher level IL learning goals. The surprisingly small amount of geography issues both in the expressed problems and learning experiences suggests that this was not the case in our classroom. The teacher expressed that the main learning goals concerned cultural geography but the long list of other goals might have affected the students’ views and reflections (see the first section of the results).

The wide variety of problems expressed by the students are a manifestation of the uncertainty principle by Kuhlthau (2004, 89 to 92) and the notion of task complexity by Byström and Järvelin (1995) in our data. The importance of finding a focus on the personal learning task has been well recognized in the information seeking research as a key to managing the uncertainty problem. However, our results reveal that the problems of novice learners do not only deal with how to find a focus for a study or how to learn about a new topic. The complexity of the learning task brings in the need to learn, for example, the practices of inquiry-based learning, how to organize one’s work, and how to apply new tools. The question is how much uncertainty and complexity the novice learner can afford in a productive manner in a single assignment. This problem calls for planning embedded IL instruction as an integrated part of the school’s curriculum (See Kuhlthau et al 2007, p. 93-109) where the various aspects of inquiry-based learning and information literacy practices can be adopted cumulatively in manageable bits.

The teacher’s support was mainly based on two strategies, expert support and ideas and encouragement, which covered nearly 80% of the support expressions. Collaboration strategy was used only in 14% of the problems. Collaboration matches the goals of inquiry-based learning well but requires that the teacher be able to allocate a substantial amount of time and effort to personal interactions with students. With the group of 17 students who were novices in inquiry learning, the teacher did not have enough time to use collaboration as a primary support strategy. The good practices identified by Limberg et al. (2008) and Kuhlthau et al. (2007, 137 to 138) to enhance collaboration between students to share experiences and ideas, raise questions and compare views might decrease the load of the teacher and improve learning. However, collaboration does not suit all learning
styles. Herring (2006) found that most students saw group brainstorming as a positive experience but some students preferred to, and see it more effective to work on their own.

In this study, we followed the work process of one class of students in the context of a single learning task. These restrictions are present in our study and its results. Data was collected using a range of techniques such as observation, teacher and student interviews, questionnaires and completed research papers. The results from the various segments of data supported each other which do raise the validity and reliability of the study. A case study in an authentic environment increases our understanding about the phenomenon of interest but even more it provokes to think what might be the most urgent problems for further studies.

The findings of this study indicate that the analysis of communicative interactions in the classroom is a promising approach to contribute information literacy studies. The approach is effective in revealing the practices of information seeking and use intertwined into the practices of schooling. The focus on communicative interactions and collaboration opens also an avenue to study how various instructional designs and ways of scaffolding can be used to support embedded information literacy instruction and integrate it into the school’s curriculum.

References


