"It's easier to read on the Internet—you just click on what you want to read…"

Abilities and skills needed for reading on the Internet

Maria Rasmusson · Monica Eklund

Abstract Today's youth spend a lot of time on the Internet where they meet a multimodal world. The focus in the present study has been on the skills and abilities needed for on-line reading. This study explores reading on the Internet, with pairs of Swedish students aged 10 and 15. The pairs completed tasks on the Internet and these sessions were video-taped. Five main categories of skills and abilities were found: traditional literacy, multimodal literacy, path-finding, IT abilities, and information abilities. The results support earlier research in the field at large, and also add to the literature on on-line reading, in areas such as the crucial need for the ability to spell and knowing web address conventions in English.

Keywords Reading · On-line reading · The Internet · Multimodality · Text

The Internet and digital information sources have increased and the reading of electronic texts has become necessary and prevalent in society during the last decades (Education Council 2006). In Sweden 99% of the students aged 12–16 have Internet access at home. These students use the Internet 12.6 h per week at home and 1.2 h per week at school on average (Findahl and Zimic 2008). In Europe 58.4% of the population use the Internet and the percentage of use in Iceland, Norway and Sweden is over 90 (Internet World Stats 2011). Research has shown that the development of technologies makes new demands on, and broadens the concept of reading literacy (Leino 2003). In other words, reading has changed due to the new digital media particularly with respect to how information is approached and comprehended. Electronic reading includes not only traditional literacy but also the ability to 'read'

M. Rasmusson (✉)
The Department of Education, Mid Sweden University, SE-871 88 Härnösand, Sweden
e-mail: maria.rasmusson@miun.se

M. Eklund
Halmstad University, Box 823, SE-301 18 Halmstad, Sweden
e-mail: monica.eklund@hh.se

images, videos and the whole context of which the text is a part. This paper explores abilities and skills needed for reading and meaning-making on the Internet.

The research in the field of reading and literacy reveals different theoretical perspectives. For example, one finds either the more traditional reading theories, often more focused on the cognitive processes (Adams 1993; Stanovich 2000; Pressley 2006) or, in the new literacies, research where reading is regarded as an activity in a broader sense and where sociocultural aspects are taken into account to a larger degree (Barton 2007; Gee 2008; Street 1984; Lankshear and Knobel 2003; Coiro et al. 2008). Today a New Literacies Perspective (Lankshear and Knobel 2003; Leu et al. 2004) is frequently referred to and there is an on-going debate about what new literacies are. "A New Literacies Perspective tells us that Internet and other continuously emerging information and communication technologies (ICT) will be central to literacy in both our personal and professional lives and that these technologies require new literacies in order to effectively exploit their potential" (Leu et al. 2004, p. 1599). The present study takes its point of departure in a New Literacies Perspective. From such a perspective the term *text* is not only used for written text, but also includes images, videos and other modes of communication found on the Internet. This is what Kress (2003) calls multimodal texts. The concept *reading* in the present study includes the meaning-making process, encompassing an expanded notion of reading. Meaning-making refers to how the reader can combine different semiotic modalities from a text, a "multimodal text," to create meaning. Language can be seen as one semiotic system among other modes to make meaning (Halliday and Hasan 1985). In other words, on-line reading is seen as a broader activity than, for example, Hoover and Gough's (1990) simple view of reading where reading is the product of decoding and comprehension.

It is clear that text on the Internet differs from printed text. The World Wide Web (WWW) combines different media forms such as magazines, newspapers, graphic design, photography, radio, film and television. These media are used on the Web to create new forms of communication. There are many different niches with many different forms on the Web and it is, therefore, difficult to talk about only one kind of design for the Web (Bolter and Gromala 2003). In spite of the diversity on the Internet there are common design conventions, for example, persistent navigation links are often placed on the left or at the top of the page. In an eye-tracking study that investigated how people search a web page, it was found that the users quickly adapted to new layout designs even when the design violated the conventions (McCarthy et al. 2004). A printed book is typically read linearly from the first to the last page. On the Internet there are hypertexts that have embedded links to other texts. The reader does not have to read the text linearly but instead can easily jump back and forth between different texts (Kamil et al. 2000). These hyperlinks are a feature that is characteristic of texts on the Internet.

There is research that have attended to related areas connected to activities on the Internet and some of these have generated hypothesis about on-line reading as well (Aarseth 1997; Coiro 2003; Kamil et al. 2000; Kress and Van Leeuwen 1996; Leu et al. 2007). Only a few studies have been focused on on-line reading per se (Coiro and Dobler 2007; Leu et al. 2007; Walsh et al. 2007).

In reviewing previous studies of on-line reading it becomes evident that such reading requires some skills and abilities different from the traditional reading of

printed text but the results are not consistent and calls for more research in the field (Chan and Unsworth 2011; Coiro and Dobler 2007; Leu et al. 2007; Walsh et al. 2007). It is argued that prior knowledge sources, inferential reasoning strategies, and self-regulated reading processes were required for successful Internet reading experiences (Coiro and Dobler 2007; Coiro 2011). In the PISA-study 2009, integrating, accessing and evaluating information are identified as essential competencies for online reading (OECD 2011). Walsh et al. (2007) could see that the students' reading responses and understanding seemed to be at a literal and often superficial level. In their study, the students did not make inferences or evaluations neither did they read critically. However, the Internet has made reading from multiple sources commonplace, which demands competencies such as being able to evaluate sources and construct coherent representations of the content (Strømsø et al. 2008). Leu and his colleagues (2007) found that not all the students in their sample had the same level of reading proficiency on-line as they had off-line. The authors argue that this supports their notion that on-line and off-line reading comprehension is not isomorphic. This is in line with Coiro (2003) who suggests that the reading comprehension process is different on the Internet and that we need to find new constructs of reading comprehension that introduce students to strategies for these new literacies. From a New Literacies Perspective, on-line reading comprehension is seen as more contextually situated than the traditional reading comprehension models (Leu et al. 2007). Leu and his colleagues (2007) defined on-line reading comprehension as involving five functions: identifying important questions, locating information, analyzing information, synthesizing information, and communicating information. These functions partly overlap traditional reading comprehension abilities and contain the skills, strategies, and dispositions that are characteristic for on-line reading comprehension (Leu et al. 2007).

We believe that the present study will add to the picture above and help shed more light on on-line reading.

The aim is to explore some skills and abilities of importance to on-line reading. The research question is: Which skills and abilities are most important and necessary for students' on-line reading?

1 Rationale

The data are interpreted and discussed based on a number of relevant concepts that will be elaborated below.

Lave and Wenger (1991) used the concept *structuring resources* about resources that shaped the process and content of learning possibilities. Lave (1988) describes how knitting is a structuring resource for her own reading. She can wait to turn the page in her book until she has finished knitting a whole row, for example. Reading can also shape the process of knitting since she might read to the end of a page before she starts a new row (Lave 1988). Analogously, it is possible that the computer and the Internet can be seen as a structuring resource for reading. It is, for example, possible that Internet sites' structure and features shape the process of reading. This concept, structuring resources, will be used in the discussion of the results.

When Kress and Van Leeuwen (1996) talk about the *grammar of visual design* they use the concept design in a specific way; design is the way in which the reader can combine different semiotic modalities from a text, a *multimodal text*, to create meaning. Kress and van Leeuwen argue that the reader is designing when reading. Another important concept Kress (2003) uses about reading on the Internet is *multiple reading paths*. The Internet offers *multiple reading paths* in contrast to printed text. The reader's interest determines in which order they will read the elements and which reading paths they will choose (Kress 2003). Aarseth (1997) points out that these multiple paths expose the reader to the risk of rejection or of getting lost. The reader of cybertext is constantly reminded of strategies that are inaccessible and of the paths not taken. This makes the reading of cybertext different from reading printed linear text (Aarseth 1997). The concepts *multimodal text* and *multiple reading paths* will be used in the discussion of the results of this study.

2 Method

This is a qualitative study, done with video-recordings, with an exploratory thrust due to the lack of previous research on reading on the Internet (Leu et al. 2007). Rogoff's (1990) concept *guided participation* has inspired the design of the study. "The concept *guided participation* refers to the processes and systems of involvement between people as they communicate and coordinate efforts while participating in culturally valued activity" (Rogoff 1995, p. 142, emphasis in original). In the present study, it is the guidance that helps to make salient the skills and abilities needed for on-line reading. More precisely it is the older student's guidance of the younger student that exposes the reading activity.

2.1 Design

The study was carried out in two steps: (1) 10 year olds and 15 to16 year olds were interviewed about their Internet habits, (2) pairs of students, one from grade 4 and one from grade 9, were video recorded completing tasks on the Internet, and complementing follow-up interviews were conducted with the pairs after they completed the Internet tasks.

(1)   Step 1 was carried out to give a foundation for the construction of the tasks in the main study. The aim was to make the tasks as similar as possible to the students' normal activities on the Internet in their spare time and in school. The students were also supposed to be familiar with the content, the type of tasks, and Internet sites used. It was also important to make the tasks interesting for both the students in grade 9 and in grade 4.

Here follows a description of the tasks that evolved from step 1: Ten tasks were constructed in total. Some of the tasks were open, without any right or wrong answers, a couple of tasks were more structured and had only one correct answer, and some tasks were somewhere in between. Some tasks were directed towards a specific Internet site and some let the students use whichever site they found best suited for the purpose.

One example of a *closed* or *structured* task is as follows. The students were asked to open a Swedish cartoon web site, Bamse.net, and find out how Bamse (a cartoon bear) was related to Anna-Cilla in Bamse's family tree. This task only had one correct answer. Anna-Cilla was Bamse's grandmother on his mother's side. The task was challenging in many different ways. First of all, the students had to write the web address correctly to be able to find the site. Secondly, it was not easy to find the link to the family tree at Bamse.net. Thirdly, the family tree opened up in a new window where only a part of the tree, not including Anna-Cilla, was visible. The students had to figure out how to use a navigation tool to be able to see the whole tree. Finally, this task mainly showed whether or not the students had the skills and abilities needed to managed the family tree page. As seen in Fig. 1, there was not much traditional text so the students had to figure out how to analyse the family tree with help from signs and pictures.

One example of an *open* task is as follows. The students were told they were going on a school trip and they wanted to go to Skara Sommarland, a Swedish water amusement park. Their task was to find arguments to convince their classmates that the best place to go on their school trip was Skara Sommarland. The students were free to use any website to finish the task.

(2)   In step 2, a student in grade 9 guides a student in grade 4 when completing tasks on the Internet. The test leader is also involved in the process and gently guides
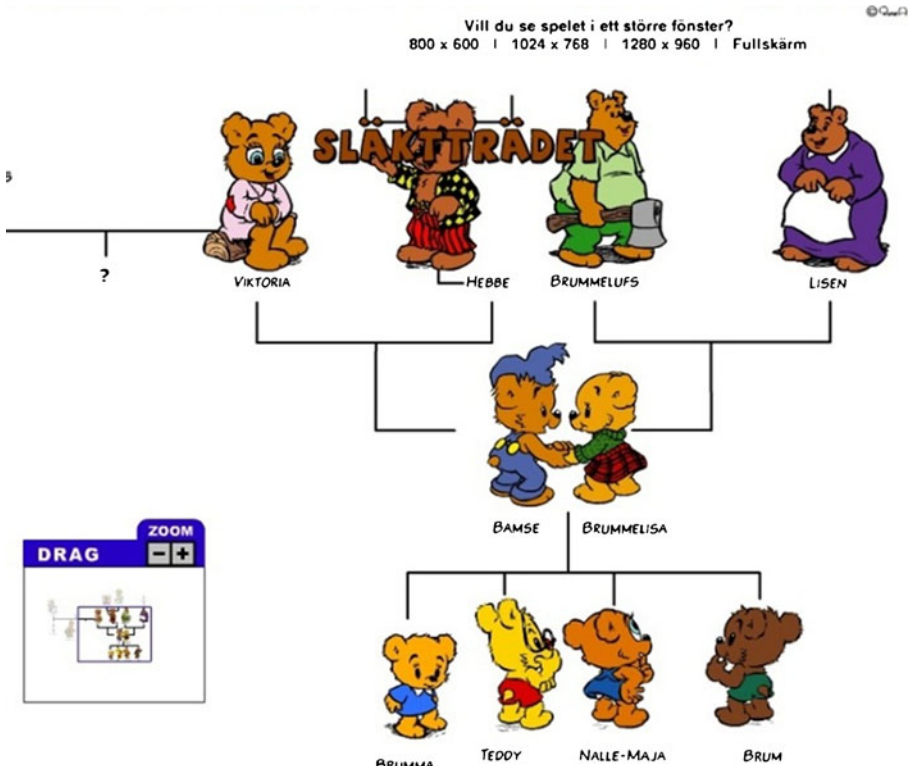

Fig. 1 Bamse's family tree. Retrieved from www.bamse.net

the students when needed. Through this design, where the grade 9 student is forced to explain how to solve the tasks, it is possible to get an idea of the students' abilities or skills in reading on the Internet. If the video recordings had been done during the students' normal activities it would probably have been hard to arrive at an understanding of the abilities or skills students need when reading since capabilities are not necessarily explicit. Even if two students in a non-constructed situation were working together they would probably not explain what they were doing in detail since they would be almost equally skilled and a lot of what they did would be obvious to both of them. Another possibility could have been to use a think aloud protocol but because of the drawbacks of the method think aloud was not considered as an alternative in this study (Bereiter and Bird 1985; Ericsson and Simon 1980).

After completing the tasks on the Internet the student pairs were interviewed about the tasks and about reading on the Internet in general. This was mainly done to find out whether the students perceived the tasks as being easy or difficult, interesting or boring.

2.2 Participants and sampling

In step 1, seven students aged 15–16 were interviewed in pairs or alone and six students (interviewed in group) aged 10.

Students in grade 9 (15-year-olds) and grade 4 (10-year-olds) in the Swedish compulsory school participated in step 2. The students were chosen from two schools in a medium-sized Swedish city. The principals in the two schools were contacted and, in their turn, arranged the contacts with the students' teachers. Teachers had to be willing to participate and the parents had to be willing for their children to be filmed. Seven pairs participated in the study. In the first two sessions one pair consisted of two boys and the other pair was one girl and one boy. After evaluating video recordings of the first two sessions the decision was made to only use same sex pairs, that is, boy-boy and girl-girl. The younger girl in the first session seemed very shy and a bit inhibited when she worked on the tasks with the older boy. To avoid this kind of discomfort it was decided to only use same sex pairs. The first two sessions were included in the study and another five pairs were filmed. In total, there were two pairs of girls, four pairs of boys, and one mixed pair.

2.3 Procedure

The interviews in step (1) each lasted for 40–60 min and were audio recorded.

The main study (2) was carried out at the students' schools in a room with Internet access. A student from grade 9 and a student from grade 4 sat together in front of a computer with Internet access. The DV-camera was placed behind the students and the computer screen alone was recorded. A microphone was placed in front of the students to record their conversation. Each session with a pair of students lasted between 30 and 40 min. The students were given oral instructions by the test leader and the older student guided the younger student who controlled the computer. The test leader intervened when necessary, for example if the students had reached a dead end or something similar. After the Internet session the pairs were interviewed about

how they perceived the tasks and about their understanding of reading on the Internet. These interviews were audio recorded and evaluated in order to improve the tasks continuously during the study.

2.4 Data processing and analysis

The whole corpus of video data encompasses 4 h and 9 min and all of the seven video recordings were fully transcribed, both the conversations and the activities on the screen, using ELAN Linguistic Annotator version 3.8.1 (Max Planck Institute for Psycholinguistics 2009). The transcriptions were made to ensure nothing in the material was missed. Below, we present excerpts from the material where both what is said and what happens in the video recordings are included. The latter is presented in double parentheses.

In the first step critical situations were analyzed. To begin with all situations where the student in grade 9, or the test leader, had to intervene in order for the work with the tasks to continue were picked out. These situations were analyzed and only the ones that were crucial for reading and meaning-making were selected. For example, sometimes the students had problems that were connected more to the specific task than the reading and meaning-making. Those kinds of situations were sorted out. The situations where the students lacked the necessary abilities or skills were of interest since the abilities that are lacking are obviously of importance to complete the tasks. To complete the tasks the students needed to make meaning out of the text (in a broader sense) on the Internet, thus they had to read the Internet. These critical situations, both transcripts and video recordings, were analyzed and categorized. Initially, when the data was categorized, it was sorted and nine categories necessary for reading on the Internet became visible. These categories are described below. The critical situations were selected regardless of whether it was the student in grade 9 or the student in grade 4 that got stuck as long as it illustrated an important ability or skill. These categories partly overlapped and therefore five main categories were created. The sub categories, emanating from the initial categorization, were then fitted into these main categories.

3 Results

A number of abilities and skills necessary for reading and meaning-making on the Internet were identified and will be described and discussed below. All the excerpts from the transcripts are translations from Swedish to English made by the authors.

3.1 Traditional literacy

First it was found that traditional literacy-skills are crucial for reading and making sense of information on the Internet. We found that reading and writing seemed to be more intertwined than in traditional literacy. A person needs to be able to write and spell to find what they are looking for on the Internet. There are two sub-categories in this category.

Writing and spelling Being able to write and spell was seen to be crucial for searching for sites or writing web addresses. A small misspelling in a web address

can result in a completely different web page than the one sought. Spelling is also important when searching the web with a browser even though web browsers can sometimes identify misspellings and suggest the correct words. A number of examples where misspelling causes the students problems can be seen in the videos. Some students misspell dwarf planet in Wikipedia's search engine and others misspell web addresses and search words in Google. One strategy students used was to try different spellings until they succeeded but, in one case, the students did not realize that they were on the wrong web page due to an incorrect web address. Google and Wikipedia are quite good at suggesting the right spelling, i.e. Wikipedia asked the boys "Did you mean dwarf planet?" but the boys did not notice the suggestion. Two examples where spelling has been crucial are shown below.

In the first example, a pair of boys misspelled "swine flu" when they tried to search for "advantages disadvantages swine flu" in Google and therefore got no results. The boys recognized this error and tried again but made another spelling mistake. This time Google identified the right spelling, suggested the right word, and the boys got the search result they were looking for.

In the second example, a pair of girls was trying to find a web site called Bamse. net, a Swedish cartoon bear's site. In the excerpt below, the girl in grade 4 (Student 4) is in control of the computer and is trying to write the web address. The girl in grade 9 (Student 9) helps her with the spelling.

> Student 4: so (.) it was Bamse dot net?
> Student 9: mm
>   ((The student in grade 4 types Banse.nät))
> Student 9: I think it should be an e (.) dot net (.) with e
> Student 4: what?
> Student 9: with e in net
> Student 4: maha (.) no
> Student 9: mm I think it should be that way
>   ((The student in grade 4 changes the web address to banse.net and they end up on a web page called "Reino Banse" instead of bamse.net))

The girls end up on a completely different web page but they don't realize this until the test leader tells them. This example is quite significant in showing the importance of spelling since it is only a minor spelling mistake, the letter n instead of m, which leads the students to the wrong web page.

Traditional reading It is important to have traditional skills in reading to be able to comprehend the pages fully. All the web pages in the study contained more or less traditional text. A couple of the students in grade 4 used the mouse cursor to follow the text word by word as they read silently. Two more students in the same grade read the text out loud and in one case it was almost impossible to hear what a boy was reading. Although he seemed to skim through the text and misread many words or skipped words, he had a good reading comprehension. Some of the students in grade 9 were reluctant to really read the texts. They were content once they had found a page that they thought contained the answer to the task. The impression was that these students thought the tasks in this study (or reading on the Internet in general?) was only about searching for and *finding* a web page. They seemed to want Internet

activities to have a rapid pace. The following is an excerpt of a situation like this where the students are looking for information about the amusement park Skara Sommarland:

> Student 9: eh (.) if you want to persuade them (.) probably you read it through
>   ((20 seconds later when some activities and conversation have taken place between the students))
> Student 9: yes if you want to persuade them (.) you probably click something here and read it through
>   ((a minute later when some more activities and conversations have taken place between the students))
> Student 9: yes (.) if you want to persuade them (.) probably you read this through
> Test leader: mm
> Student 9: and you tell them what's good

It was clear that this student thought they had completed the task once they had simply found a web page where the needed information could be found. This was in spite of the fact that the majority of the students seemed to regard the tasks as schoolwork. Good traditional reading comprehension, in combination with a willingness to read on the Internet, is important. Successful reading is a question both of abilities and attitude towards the traditional texts found on the Internet.

3.2 Multimodal literacy

In a multimodal approach to literacy, signs are a combination of form and meaning. Modes are the various forms used to construct the signs or visual images (Kress 2003). On the Internet, there are many different modes that construct the signs, not only the letters of the alphabet. A web browser usually displays a hyperlink in some distinguishing way, for example in a different font, colour, or style. The way the hyperlink is displayed is the mode that constructs the sign of a hyperlink. To be able to make full meaning of web pages a person needs to be able to 'read' different modes of text often in combination with traditional text. Being able to make inferences between pictures, text, and symbols is important in the meaning-making process of reading multimodal texts on the Internet.

Here is an excerpt of a situation where a pair of girls prefers the mode of a music video (see Fig. 2) to complete the task rather than reading the traditional text in the articles. The girls are supposed to explain the difference between hip-hop and hard rock using two articles with both text and music videos on a site called "Kamratposten.se". The girls chose to listen to the videos instead of reading the texts and, then, explained what they perceived as the difference.

> Student 4: first of all hip-hop is like a story you talk at the same time (.) but you sing
> Student 9: mm
> Student 4: that is the first
> Student 9: and then it is more dance friendly than hard rock.

These web-based articles had good affordances and the girls chose the music video mode which, evidently, gave them some information. They would probably have

Fig. 2 An example of an article, used in one of the tasks, about hard rock that contains many different modalities. Retrieved from www.kpwebben.se

been able to give a more evolved (in a school sense and context) answer if they had read the traditional texts too.

3.3 Pathfinding

This main category illustrates the ability to be a path-finder and navigate the Internet "jungle." *Pathfinding* includes different skills and abilities. Perhaps the most important one is to have experience from sites with a variety of designs.

Choosing the right path Students have to choose a strategy to find what they are looking for. Students who lack successful strategies for finding what they are looking for might give up or find their search to be very time consuming. Most students in the study chose the search engine Google and, most often, chose the first item on the results page. One pair of girls who were looking for information about the amusement park "Skara Sommarland," agreed that they should "google it." Unlike the other students, they went through the search engine results quite carefully and ended up choosing a web site called "Barnguiden.com" (Children's guide). This strategy was successful since the web site they found summarized the information they needed on one page. All the other pairs clicked on the first item on the search results page in this task. Overall, only a few of the students wrote the web address directly in the address bar in the web browser. It was more common to use Google's search engine to find web sites. In some instances, the borders between search engines and web addresses are erased. This is the case in the latest web browsers, such as Google Chrome, where the address bar doubles as a search bar. However, the Google Chrome web browser was not used in this study.

Pathfinding also includes the strategies the student uses once they have found a web site that they believe is useful for the task. An example of this strategy happened in the study when a pair of boys were going to find a game at a game site called blip. se. The boy in grade 4 tried to search for the game in a search engine at the site where it said "Search users". The boy might have intended to use a general search engine for the site at the top of the page and didn't read carefully. The student in grade 9 stepped in and suggested that they should look in the drop-down list under the game category called "Strategy" since he had figured out that they were looking for a strategy game. The boys did indeed find the game in the drop-down list and were able to complete the task.

This example shows that there can be different paths that lead to the same result and that a strategy that is successful on one site does not always work on another site. There are some conventions but there is also a great variability between sites. The more experience you have from different sites the more strategies you have in your repertoire.

Search strategies The focus here is on the specific searching skills such as choosing the right search word, narrowing the search if need be, and using the different search features offered in the search engines. This area has been quite well investigated (Coiro and Dobler 2007). Being able to evaluate information goes hand in hand with searching abilities. The present study gave examples of basic skills in searching but since significant research (see, e.g. Alexandersson et al. 2001; Bergman 1999; Gordon 1999 & Nilsson 2002) has been done in this field it will not be elaborated here.

Recognizing a dead end If you are searching for something specific it is not always obvious that your path has come to a dead end. Many different skills are needed to be able to identify a dead end. These capabilities include; skills in reading, knowing what you are looking for, avoiding being distracted, and being persistent and not giving up. If you lack the ability to identify a dead end right away it will be an effort to get back on the right track. Here follows an excerpt where two boys ended up at a different site than the one intended. At first they did not realize this problem and, when they did, they had trouble getting back to the earlier page since a new window had opened automatically. The boys were supposed to go to one TV show's site and do a test but they ended up at another TV show's site which had opened in a new window.

> Test leader: you can go to svt.se now and do a quiz at Bobster (.) you can choose any test you like
>   ((The student in grade 4 clicks on the Bolibompa logotype and that opens a new window with the Bolibompa site))
> Student 4: now it's supposed to be here
>   ((He scrolls the page down and up again.))
> Student 4: °might have to search° (.) isn't it possible to go back?
>   ((The student in grade 9 presses a key on the keyboard but nothing happens on the screen))
> Test leader: you probably have to close that window since it opened in a new window
>   ((The student in grade 4 closes the window and is back at svt.se))

In this example the boy in grade 4 probably mixed up the two TV shows and had trouble getting back. The study showed many examples of students who followed the wrong path, had a hard time recognizing that, and finally had trouble getting back to the original site. It is simple and quick to click your way through the Internet which makes it easy to get lost.

3.4 IT abilities

The main category *IT* contains the abilities that are attached to the technical aspects of reading on the Internet. To be able to access the Internet you need to be able to use the computer and the web browser. Most students in Sweden have the basic IT competencies needed to use a computer (e.g. handling the mouse, the scroll wheel, and keyboard). Most are also able to use the basic features offered in the web browsers (e.g. the scroll bar and the web address bar) (Findahl and Zimic 2008). Surprisingly, not all of the students in the present study were familiar with using tabs in the web browser, mouse-over features, or understanding when objects on the screen were clickable (superimposed hyperlinks).

General computer abilities This category covers the ability to use a computer at a basic level. None of the students in this study showed any problems with this. They used a mouse, a touch-screen display, a scroll-wheel, and the keyboard with ease. All the students used the mouse cursor to point at things they talked about on the screen. The mouse cursor seems to be a tool in the communication between the two students.

As mentioned earlier, a couple of students in grade 4 used the mouse cursor as a tool when they read silently. They followed the text, word by word, with the mouse cursor, much in the same way as following the text with the index finger.

In the present study, the students only used the web browser and thus no use of other software was observed or analyzed.

Specific web browser abilities The students in both grade 4 and grade 9 had the basic skills needed to use a web browser. The students knew how to use the scroll bar, the address bar, and the back and forward buttons. Not all students knew how to use tabs in a navigational widget to enable opening of multiple pages in the same window. Some of the students also had trouble in recognizing clickable objects which was an actual obstacle to their reading. When the cursor hovers over a hyperlink or a clickable object it changes into a hand with an outstretched index finger. This was evident at the "Skara Sommarland" web site since pictures of the different attractions are used as hyperlinks. However, not all the pictures on the website were used this way so the students had to hover over the pictures to find out which objects were clickable.

Knowing web address conventions Some conventions on the Internet are in English and the Swedish-speaking students have to learn these. It is not enough to be able to write and spell in Swedish. The students must know that a web address often ends with .net (network), .com (company), .org (organization), .edu (education), or countries' domain names, .se (Sweden). They need to learn how to spell those domain names. Since the letters å, ä and ö are common in Swedish but not in web addresses, the students also have to know how to write addresses where the diacritical marks (the rings and dots) are removed. For example, the web address for the municipality of Åmål is www.amal.se. This spelling convention is an ability the students need to attain.

3.5 Information abilities

As mentioned earlier, the main categories partly overlap. For example, the main category *information abilities* have much in common with *pathfinding*. What distinguishes information abilities is that it concerns the ability to interpret the content and how the content is structured. The Internet contains different genres such as news, blogs, games, and wikis. Each web site is also structured in a more or less well thought-out way. The design and architecture of a digital landscape is referred to here as information architecture (IA).

Recognizing the genre Students need skills in identifying the kind of web site they are visiting. For example, they might be looking for a blog and end up on a newspaper site. This category also includes the ability to critically evaluate the content of a web page. In order to do that, it is helpful to be able to identify if a company, a private person or a government is responsible for the web site.

In the following excerpt two boys are looking for a blog about swine flu and have "The swine flu blog" open. The students are not content with the blog posts they have found and therefore keep on looking. When they click on a link in the blog the

student in grade 9 immediately identifies the new page as a news site, which was not what they were trying to find.

> Student 9: then probably you should click on the link down here
>   ((The student in grade 9 points on a link below the first blog post))
> Student 4: this one? ((Points at the link with the mouse pointer.))
> Student 9: yes (.) you just have to click there
>   ((The student in grade 4 clicks on the link and a newspaper article opens.))
> Student 9: it's those kind of news (.) eh (.) if you go back one step
>   ((The student in grade 4 goes back one step and is back at the blog site.))
> Student 9: yes I suppose this is a blog about that

This *genre* category also includes the ability to evaluate content on the Internet, which is a crucial ability, but since that area is quite well investigated (see, e.g. Alexandersson et al. 2001; Bergman 1999; Gordon 1999 & Nilsson 2002) it will not be further elaborated here.

Grasping the information architecture The concept *information architecture* refers to how a web site is structured and how information is organized. There are conventions about how web sites are structured but not to the same extent as conventions for printed books. Additionally, web sites are more heterogeneous. The reader has to interpret and understand each new web site's information architecture in order to navigate the web site successfully. In the example below it becomes evident that the students are unfamiliar with the web site "MySpace" and they try to use the search bar at the bottom of the window (find users) to find an artist instead of using the search field in the upper right corner. Maybe they didn't read the text carefully enough and became confused by the information architecture on this page. The convention is, probably, to have only one search field on a web site.

The next pair consisted of a girl in grade 4 and a boy in grade 9. The students found a Swedish artist on MySpace and saw when this artist would be having a concert nearby. The student in grade 9 pointed at the search field at the bottom of the window where it says "Find users with similar interests". The student in grade 4 clicked on the drop-down list that is on the right side of the search field and choose music.

> Test leader: are there any Swedish artists that you like? (.) EMD, Agnes or Alice? (.) which others are there?
> Student 9: just write down an artist (.) then find ((The student in grade 4 writes down EMD in the search field and clicks the button "Find".))
> Student 9: eh (.) and then you get a lot of…
> Test leader: which artist did you choose?
> Student 9: yes she wrote EMD and then we got a lot of users (.) and that is (.) none of them looks like
> Test leader: but maybe you should try to search up there (.) I think that is better

Even though there are some conventions on the Internet but there are also many ad hoc solutions that can cause confusion. It is clear that the students in grade 9, who are more experienced Internet users, are also more skilled in grasping the information architecture. It is likely that they have attained this skill through trial and error. Their

repertoire of knowledge about different ways of structuring information is far greater than the students in grade 4.

4 Discussion

What skills and abilities, that are important and necessary for the students' on-line reading, become visible? The results from the present study indicate that reading on the Internet involves quite a number of different skills and abilities.

The results point towards five main categories of skills and abilities, which are important for on-line reading:

- Traditional literacy
- Multimodal literacy
- Pathfinding
- IT abilities
- Information abilities

The tasks were created to be as similar as possible to the students' normal activities on the Internet both at school and in their spare time. Although many of the tasks were quite open, the students seemed to interpret them as school tasks and regarded the test leader as a teacher. The fact that they completed the tasks in a school environment may have influenced them to perceive the tasks this way, which indicates that the activity is situated in context.

The co-operation between the students (and occasionally with the test leader) can be seen as an important part of the meaning-making process. Rogoff (1995) saw *guided participation* as the processes and systems of involvement between people as they complete tasks in a culturally valued activity. Guided participation was one of the prerequisites for the study since the study design was inspired by Rogoff's theories. It was apparent that the student in grade 4 received guidance from the student in grade 9. The test leader was also involved in guiding the pairs when needed. This design emphasised the students' skills and strategies more clearly.

The computer and the Internet can be regarded as "*structuring resources*" (Lave and Wenger 1991). For reading, for example the information architecture of an Internet site gives shape to the reading. The screen, the mouse and the speed of the Internet connection also structure the on-line reading. These structuring resources shape the activity and make on-line reading different from reading printed text.

Kress (2003) stresses the existence of multiple *reading paths* and the *multimodal characteristics* of on-line reading, which is in line with the results of this study. First of all, we could see that the participants chose different reading paths although the pairs had the same tasks. The tasks did not include what path to choose but rather indicated a goal for the activity. In fact, it was not important for the aim of the study, whether the goal was reached or not. The tasks were the same for all pairs and the focus of the study was on how students solved the tasks and what strategies they used. Secondly, it turned out that all pairs were quite skilled in reading the different modalities. These skills became evident as it was seen that the students were able

to make meaning of the multimodal characteristics of the web pages, such as pictures, videos, and signs as well as traditional text.

It is worth noting that the reading activities may be interpreted both from a traditional text perspective and from a school perspective. In the results section, we referred how one pair of students chose to listen to music videos instead of reading the traditional text. This is an example where it may be suspected that an answer that related to the text is valued higher than an answer drawing on solely the music videos. There is probably a risk that we tend to value traditional text higher than other modalities, at least in a school context. Maybe it is time to question such a perspective, if any. It is possible to argue that reading on the Internet is a completely different activity from reading traditional text. In addition, there is a mix of different *genres* on the Internet. In a traditional book or a newspaper you often know in advance what genre to expect and in what way you need to be critical in your reading. On the Internet, one click can take you to a completely different genre with a completely different author. This calls for a special awareness that the school should help the students to develop.

Aarseth (1997) calls attention to the risk of getting lost and being rejected on the Internet. He suggests this to be one thing that makes reading on-line different from reading off-line. The results of this study show that the students do get lost and sometimes have great trouble finding a successful path among the multiple possibilities. This could be related to the presumption that there is a correct path and a certain goal. It should be considered that the test leader was there and interpreted the students' *pathfinding* as more or less successful. In fact, you could, as well, interpret reading on the Internet as an activity where you cannot get lost and every path you chose can be equally correct.

4.1 Closing remarks

Quite obviously, there are limitations to the present study, some of which will be pointed out here. The number of participants was rather small. However, this is not unusual in qualitative studies. We are convinced that the design used made the students' strategies, skills and abilities salient enough. A larger number of participants and a more diverse set of tasks had certainly supplied us with more examples of abilities and skills, but most probably not rendered different results per se. In designs like the one used in the present study, the selection of subjects are not, as a rule, conducted with random sampling procedure. Instead other methods are use for selecting participants. Two different schools in different housing areas were involved and we tried to get a reasonable spread with respect to gender. Even if there was certain voluntariness the information given to all students emphasized that no special skills in computers were needed for participating. Moreover, it may be argued that regardless of the students' skills in using computers it is possible to observe what strategies are used. Apparently, statistical claims can not be made from data if this kind. However, there is no reason to believe that the students in this study differ very much from other students. Thus, it seems reasonable to assume that the abilities and skills found to be necessary for reading on the Internet are necessary also in a wider community. It needs to be stressed, though, that further research is desirable to validate the present results. Of course, it would be interesting to investigate the

findings in large scale quantitative studies as well, with the gains (and losses) such a design can provide.

It also deserves to be pointed out that the results presented here are in line both with many on-line reading theories and earlier studies. Furthermore, they add to the picture by bringing out *spelling* as a critical competence in on-line reading. Since using search engines to find web sites or writing a web address in the address bar are useful approaches, it is important to be able to spell correctly. Another aspect that this study adds to the literature is the observation that reading is facilitated if non-English speaking students know some English spelling.

In summary, there are essential abilities and skills that the youngsters need to learn in order to have full access to the information on the Internet. Teachers and school authorities must consider how to ensure that all students develop these abilities and skills. Educators also need to be aware of constantly developing technology. Maybe the most important skill to learn is how to keep up to date with new literacies that appear on-line. Leu et al. (2007) advocate that the new literacies are best acquired through social exchange and construction, rather than through formal and direct instruction. However, educators need to consider how to ensure that coming generations will gain a high quality of on-line reading comprehension. This is an important task for school, and especially so since reports show that youngsters mostly use the Internet at home (see, e.g. Findahl and Zimic 2008). However, having the skills and abilities needed to read on-line is, among other things, a question of democratic rights. This makes it even more important to schools to offer all students the opportunity to gain equally good skills and abilities to access and read on the Internet regardless of socioeconomic status and conditions at home.

References

Aarseth, E. J. (1997). *Cybertext: Perspectives on ergodic literature*. Baltimore: The Johns Hopkins University Press.

Adams, M. J. (1993). *Beginning to read: Thinking and learning about print*. Cambridge: MIT Press.

Alexandersson, M., Linderoth, J., & Lindö, R. (2001). *Bland barn och datorer: lärandets villkor i mötet med nya medier.* [Among children and computers: the demands of learning meets the new media] Lund, Sweden: Studentlitteratur.

Barton, D. (2007). *Literacy: An introduction to the ecology of written language* (2nd ed.). Malden: Blackwell.

Bereiter, C., & Bird, M. (1985). Use of thinking aloud in identification and teaching of reading comprehension strategies. *Cognition and Instruction, 2*(2), 131–156.

Bergman, M. (1999). *På jakt efter högstadieelevers Internetanvändning: en studie av högstadieelevers Internetanvändning och Internet som kulturellt fenomen i skolan.* [On a hunt for senior compulsory school students' Internet use] Licentiate thesis. Uppsala, Sweden: Uppsala University.

Bolter, J. D., & Gromala, D. (2003). *Windows and mirrors: Interaction design, digital art and the myth of transparency*. Cambridge, Mass.: MIT.

Chan, E., & Unsworth, L. (2011). Image–language interaction in online reading environments: challenges for students' reading comprehension. *The Australian Educational Researcher 38*(2), 181–202. doi:10.1007/s13384-011-0023-y.

Coiro, J. (2003). Exploring literacy on the internet: reading comprehension on the internet: Expanding our understanding of reading comprehension to encompass new literacies. *The Reading Teacher, 56*(5), 458–464.

Coiro, J. (2011). Talking about reading as thinking, modelling the hidden complexities of online reading comprehension. *Theory Into Practice, 50*, 107–115.

Coiro, J., & Dobler, E. (2007). Exploring the online reading comprehension strategies used by sixth-grade skilled readers to search for and locate information on the internet. *Reading Research Quarterly, 24*(2), 214–257.

Coiro, J., Knobel, M., Lankshear, C., & Leu, D. J. (2008). Central issues in new literacies and new literacies research. In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu (Eds.), *Handbook of research in new literacies* (pp. 1–21). Mahwah: Erlbaum.

Education Council. (2006). *Recommendation of the European Parliament and the Council of 18 December 2006 on key competencies for lifelong learning*. Brussels: Official Journal of the European Union, 30.12.2006

Ericsson, K. A., & Simon, H. A. (1980). Verbal reports as data. *Psychological Review, 87*(3), 215–251.

Findahl, O., & Zimic, S. (2008). *Unga svenskar och Internet 2008* [Young Swedes and the Internet 2008]. World Internet Institute. URL: [http://www.wii.se/publicerat/doc_download/15-unga-svenskar-och-internet-2008.html]. Retrieved 5 August, 2010.

Gee, J. P. (2008). *Social linguistics and literacies: Ideology in discourses* (3rd ed.). London: Routledge.

Gordon, C. (1999). Student as authentic researchers: a new prescription for the high school research assignment. *School Library Media Research Online, 2*. URL: [http://www.ala.org/ala/mgrps/divs/aasl/aaslpubsandjournals/slmrb/slmrcontents/volume21999/vol2gordon.cfm] Retrieved August 3, 2010.

Halliday, M., & Hasan, R. (1985). *Language, context and text: Aspects of language in a social-semiotic perspective*. Geelong: Deakin University Press.

Hoover, W., & Gough, P. (1990). The simple view of reading. *Reading and Writing: An Interdisciplinary Journal, 2*, 127–160.

Internet World Stats. (2011). *Internet usage in Europe*. URL: [http://www.internetworldstats.com/]. Retrieved February 1, 2011.

Kamil, M. L., Mosenthal, P. B., Pearson, D., & Barr, R. (2000). *Handbook of reading research, volume III*. London: Routledge.

Kress, G. (2003). *Literacy in the new media age*. New York: Routledge.

Kress, G., & Van Leeuwen, T. (1996). *Reading images: The grammar of visual design*. London: Routledge.

Lankshear, C., & Knobel, M. (2003). *New literacies*. Buckingham: Open University Press.

Lave, J. (1988). *Cognition in practice: Mind, mathematics, and culture in everyday life*. Cambridge: Cambridge University Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Leino, K. (2003). Computer usage and reading literacy. In S. Lie, P. Linnakylä, & A. Roe (Eds.), *Northern lights on PISA* (pp. 71–81). Oslo: University of Oslo.

Leu, D. J., Kinzer, C. K., Coiro, J. L., & Cammack, D. W. (2004). Toward a theory of new literacies emerging from the internet and other information and communication technologies. *Theoretical Models and Process of Reading, 5*, 1570–1613.

Leu, D. J., Zawilinski, L., Castek, J., Banerjee, M., Housand, B., Liu, Y., & O'Neil, M. (2007). What is New about the new literacies of online reading comprehension? In A. Berger, L. Rush, & J. Eakle (Eds.), *Secondary school reading and writing: What research reveals for classroom practices*. Chicago: NCTE/NCRLL.

Max Planck Institute for Psycholinguistics. (2009). *EUDICO Linguistic Annotator*. URL: [http://www.lat-mpi.eu/tools/elan/]. Nijmegen, The Netherlands.

McCarthy, J. D., Sasse, M. A., & Riegelsberger, J. (2004). Could I have the menu please? An eye tracking study of design conventions. *People and computers XVII-Designing for society* pp. 401–414. Springer-Verlag: London.

Nilsson, N. (2002). *Skriv med egna ord: En studie av läroprocesser när elever i grundskolans senare år skriver "forskningsrapporter"* [Write with your own words: A study of learning processes of students writing "research reports" in the late years of compulsury school](Diss.). Malmö, Sweden: Malmö högskola.

OECD (2011). *PISA 2009 results: Students on line: Digital technologies and performance (Volume VI)*. URL: [http://dx.doi.org/10.1787/9789264112995-en].

Pressley, M. (2006). *Reading instruction that works: The case for balanced teaching* (3rd ed.). New York: Guilford Publications.

Rogoff, B. (1990). *Apprenticeship in thinking*. New York: Oxford University Press.

Rogoff, B. (1995). Observing sociocultural activity on three planes: Participatory appropriation, guided participation, and apprenticeship. In J. V. Wertsch, P. Del Río, & A. Alvarez (Eds.), *Sociocultural studies of mind* (pp. 139–164). Cambridge: Cambridge University Press.

Stanovich, K. (2000). *Progress in understanding reading: Scientific foundations and new frontiers*. NY: The Guilford Press.

Street, B. V. (1984). *Literacy in theory and practice*. Cambridge: Cambridge Univ. Press.

Strømsø, H. I., Bråten, I., & Samuelstuen, M. S. (2008). Dimensions of topic-specific epistemological beliefs as predictors of multiple text understanding. *Learning and Instruction, 18*, 513–527.

Walsh, M., Asha, J., & Sprainger, N. (2007). Reading digital texts. *Australian Journal of Language and Literacy, 30*(1), 40–53.