This is the published version of a paper published in *Education Inquiry*.

Citation for the original published paper (version of record):

Possibilities and Challenges for TEL from a Student Perspective through the Uptake and Use of Digital Technologies in a 1:1 Initiative.
*Education Inquiry*, 4(4): 629-647
http://dx.doi.org/10.3402/edui.v4i4.23223

Access to the published version may require subscription.

N.B. When citing this work, cite the original published paper.

Permanent link to this version:
http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-83875
Possibilities and challenges for TEL from a student perspective through the uptake and use of digital technologies in a 1:1 initiative

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Abstract

The uptake and use of digital technologies in the classroom is studied in Unos Umeå, a joint One-to-One (1:1) project between Umeå University and the Municipality of Umeå in Sweden. This paper presents the results of a survey completed by upper secondary students (N = 923), focus group interviews (N = 7) and classroom observations (N = 22). Students see possibilities in accessing information, text skills, and work variation, while the challenges they see are difficulties in focusing on the task at hand, technical problems, and the lack of alignment between students’ and teachers’ skills in Information and Communication Technology (ICT). Using the Ecology of Resources Model (Luckin 2010), these challenges can be interpreted as the manifestation of filters in the learning environment. How collaborative learning environments are created, the lack of alignment between teachers’ and students’ ICT skills and how everyday use of computers in the classroom develops will hold implications for Technology Enhanced Learning (TEL) in the classroom.

Keywords: 1:1, digital technologies, TEL, learning, students

Introduction

The shift towards techno-classrooms aspires to achieve Technology Enhanced Learning (TEL), meeting what appears to be a growing tendency of student disengagement and consequential educational failure (OECD 2009) as well as hoping to improve student achievement (Holcomb 2009). As computers become the norm in classrooms, the use of digital technologies such as laptop computers, tablets, interactive whiteboards and mobile phones offers possibilities and challenges for TEL and brings forth new questions regarding learning practices for students and teachers. The uptake of computers in a school context of traditional classroom methods, such as lectures and pencil-and-notebook work, is perhaps the first step within a system continuing to struggle to respond to technology by optimising limited resources and inherited skills (Dickinson and Stewart 2001). However, technological change in the classroom requires vision, experimentation and “new roles and relationships for teachers and students” (Somekh 2008, 448).
For the Swedish school system, projects to increase Information and Communication Technology (ICT) in the classroom have been initiated by the Swedish National Agency for Education. Comprising interactive resources and websites, projects such as IT for Pedagogues and Practical ICT and Media (PIM) training have been directed towards increasing ICT competence and resource access for teachers. The agency strongly recommends continued work in developing ICT competence (National Agency of Education 2007), in line with the European Union’s intention that technological innovations are regarded as part of life-long learning for all (EC 2008). One recent step towards ICT immersion is One-to-One (1:1) initiatives, involving the distribution of digital devices such as individual laptops or tablets to students and teachers.

The research project Unos Umeå represents a possibility to follow a 1:1 initiative to study the uptake and use of digital technologies in the classroom. The project was initiated in 2011 as a joint project between the Department of Education at Umeå University and the Municipality of Umeå in Sweden. The research project involves two schools, one compulsory school and one upper secondary school in Umeå, and through a longitudinal approach it will follow the 1:1 initiative over a period of four years.

The aim of this paper is to present findings from the upper secondary school regarding students’ uptake and use of digital technologies in the classroom at the start of the 1:1 initiative, thereby providing a student perspective. The research question of interest is: With regard to the start of the 1:1 initiative, what are students’ expectations considering school results, school planning, motivation, involvement and the use of digital technologies? The possibilities and challenges in the uptake and use of digital technologies and for TEL will be discussed.

The structure of this paper will include a research review of 1:1, the theoretical framework and method. Thereafter, findings, a discussion and conclusions will be presented.

**Research in 1:1**

Research in the 1:1 field is complex, broad and somewhat difficult to interpret. This is mainly due to the definition of 1:1 initiatives since the goals, scale and results vary widely (Apple 2005). Given this complexity, it is possible to conclude that much of the research published can be said to be more evaluation-oriented than empirically-based and peer-reviewed in line with academic standards. Studies of 1:1 initiatives can be based on motivational factors, learning results, effects on student and teacher collaboration, professional development for teachers and organisational issues such as the role of the school leader and policy implementation (Penuel 2006). Thus, research in 1:1 also includes several organisational levels as well as including learning practices in the digitalised classroom (Olofsson et al. 2011). As learning is a complex area, 1:1 TEL may seek its basis in social learning involving discourse,
communities of practice, collaborative learning, internalisation of social processes or participation in joint activities (Chan et al. 2006). It is perhaps not new pedagogies that are needed, but more efficient and flexible ways of providing pedagogy (Mayes 2001). Otherwise, new technologies are no more than a “new kind of chalk and overhead projector” (Mällinen 2001, 141) without generating a change in classroom-based teaching: “new technologies, however effective in other fields, don’t inevitably lead to major change in education” (Mayes 2001, 17).

1:1 and possibilities for TEL

There may be several motives for implementing 1:1 initiatives: improved study results, increased access to computers and therefore equality of technology, more well-adapted students for the job market and improved quality in education (Penuel 2006). While Penuel (2006) reports improved results in digital competence and writing, other studies refer to computers in the classroom having minimal effects on academic results (Cuban 2001). However, in one of the largest 1:1 projects initiated in the state of Maine, USA, implementation and integration has been reported as successful with improved student learning (Silvernail and Lain 2004). Further, Silvernail and the Maine Learning Technology Initiative (MLTI) (2011) report that the Maine initiative continues to be successful, with improved writing, performance in mathematics and science, and locating and evaluating information.

Academic results are only one part of TEL environments since work with digital technologies may provide opportunities for increased interest in learning and engagement (Bebell and O’Dwyer 2010). Students learning with laptops are more engaged, reflective, and active (Holcomb 2009). Mabry and Snow (2006) report a positive impact on individual research, student responsibility, technical skills and spontaneous collaboration. Results have also shown that laptops may help with tasks involving learning, communication, expression and exploration (Lei and Zhao 2008).

Students’ use of ICT skills for learning such as online research, productivity tools, drill and practice, and communication were found to be the most frequent uses of computers in the 1:1 classroom. In addition, the 1:1 classroom has provided the potential for a transformative form of added value (Dunleavy, Dextert and Heinecke 2007). Rockman (2007) reports students experiencing a sense of pride and ownership as well as a greater sense of autonomy, independence and responsibility through the use of laptops.

Studies in the Swedish context (Tallvid and Hallerström 2009; Grönlund et al. 2011; Fleischer 2012) are well in line with international results. One 1:1 initiative in two compulsory schools in the Swedish municipality of Falkenberg (Tallvid and Hallerström 2009) showed that students’ work with texts improved in quality and length. Students experienced better planning opportunities, calmer classrooms and were happy to have direct computer access.
1:1 and challenges for TEL

While 1:1 laptops in classrooms have provided opportunities for learning, there have been concerns regarding discipline, digital literacy and over-dependency on ICT (Lei and Zhao 2008). Inappropriate use is said to have negative effects for learning, as “laptop use interfered with students’ abilities to pay attention to and understand the lecture material use” (Fried 2008, 911). This negative impact can be described as double since it affects both the learner and fellow students (Fried 2008). These challenges can also be seen in another large 1:1 research project in Sweden, Unosuno, whose findings show that, although students and teachers appear to be optimistic regarding laptop use, there is a risk of increased individual work as well as the need to reclaim the attention of students in the classroom (Grönlund et al. 2011).

Other challenges are that 1:1 initiatives take time to implement and evaluate. Initiatives are abandoned as schools lack the financial resources and staff needed for rigorous evaluation (Hu 2007). Hu (2007) adds that this often leads to schools giving up because teacher training and the integration of technology takes time. Another issue here may be structure. While unstructured use may be disadvantageous, structured use may be beneficial with the proper design (Fried 2008). In the end, it will be about generating a change in teachers’ beliefs in ICT and students’ capabilities (Apple 2005). Moreover, the initiatives are not easily assessed through traditional forms of evaluation (Lei and Zhao 2008). Seeking alternative methods to evaluate and assess laptop initiatives in schools will be important as there is limited evidence from rigorously designed research (Apple 2005).

Against this backdrop lies the research contribution of the Unos Umeå research project. The project provides an opportunity to study the uptake and use of digital technologies over time in a school context and, in turn, the possibilities and challenges for TEL in the classroom in practice, presented in this paper from a student perspective. This may prove to be more about interaction, learning in relation to technology and how technology and design are used to support learning (Luckin 2010). If “the treatment of space and place in educational studies is underexamined, undertheorized and underdeveloped” (Luckin 2010, 17), what is needed is a framework to analyse the uptake and use of digital technologies and TEL in the classroom.

Theoretical framework

The sociocultural approach can be described as developmental, regarding learning as an interaction between the individual and their sociocultural environment (Vygotsky 1978). According to Luckin (2010), it also describes the Zone of Proximal Development (ZPD) as a process in which the learner through instructional interactions with another, a person or a tool as a form of awakening achieves a higher level of learning.
As this process is social, it poses demands on the surrounding environment or context and therefore design (Luckin 2010). A framework for examining and describing learning practices in the classroom is the Ecology of Resources Model (Luckin 2010). The model places the learner in the centre of a circle surrounded by the three resource elements of Environment, Knowledge and skills, and Tools and people as a holistic view of the learner and the resources available to the learner.

Between the learner and these resources there are elements, filters, which can be said to restrain or impede the resources available to the learner. These filters are the object of analysis in this paper, including how they are manifested in the form of restraints, arising and blocking these elements. The interpretation of the filters is twofold; they can be seen as having a negative or excluding impact on the learning process or be interpreted as a source of understanding, not only providing an insight into design but also possibilities for enhancing the learning process. The process of identifying and studying filters is used in order to optimise design in technology-rich learning environments: “if the filter is restricting access to a form of assistance in a negative way then the design process can try to ameliorate that” (Luckin 2010, 121). Therefore, identifying and making filters visible can be seen as an important part of creating possibilities for change and enhancing learning through technology.

The empirical data which make up the basis of this study present possibilities and challenges in the uptake and use of digital technologies from a student perspective. These challenges can be interpreted and analysed as the manifestation of filters since the learner is encompassed in a learning environment in which traditional classroom work methods and digital technologies meet.

Context
The Unos Umeå research project is following two schools in the municipality over a period of four years. All studies will be parallel and take place within the two schools, in two classes in a compulsory school and two classes in an upper secondary school. As the project is a joint project with the Municipality of Umeå, the schools were chosen in dialogue with the municipality. The students involved in this study attend a school in central Umeå which is one of Sweden’s largest upper secondary schools, offering a wide range of programmes from vocational training programmes to study-oriented programmes. When the 1:1 initiative started to be implemented, teachers and certain groups of students, primarily in technical programmes, had already previously had computers. However, the infusion of technology through the initiative meant that all students received laptops. Prior to and upon the start of the initiative teachers were offered professional training through national ICT training programmes provided as well as in-house seminars and workshops regarding ICT skills and the use of interactive whiteboards.
Method
In the literature review provided, methodological instruments such as surveys, interviews and classroom observations are present, yet many seem to lack the parallel use of these methods over a longer period of time, as well as a practice-based perspective. Therefore, the empirical data in this study can be said to be threefold as an attempt to achieve a more complex form of data material and thus a wider understanding of how the 1:1 initiative is being implemented in this specific context through triangulation (Cohen, Manion and Morrison 2007). It entails the initial survey completed anonymously by students in the upper secondary school (late autumn 2011) at the start of the 1:1 initiative. The survey was a pen-and-paper survey distributed to 927 students, of which four were discarded, leaving a total of 923 surveys (N=923) which are included in this study. The students were given time to fill out the survey during class time as adapted to their schedules and the surveys collected by their class teachers or mentors. Based on the results of this survey, further data were collected through classroom observations (N = 22; in total 26 hours; spring term, 2012) and seven follow-up focus group interviews with students in small groups of 3–5 students (spring term, 2012).

Survey themes
The survey was based on a five-grade scale and open questions regarding four themes: access to digital technologies, use of digital technologies in school and at home, a self-evaluation of skills in digital technologies, and own learning related to digital technologies. The questions within the first theme regarded access to computers at home, broadband, mobile phones and students’ overall view of the 1:1 initiative. The second theme posed questions about how students used digital technologies at home and in the classroom. The third theme regarded self-evaluation questions concerning ICT skills. The final and fourth theme, own learning related to digital technologies, asked questions about whether school work with digital technologies was facilitated, made more fun, or if students’ use of a laptop increased their level of responsibility for their schoolwork. As the survey entailed 20 questions and 21 sub-questions, in some surveys students either missed or skipped questions, mainly by missing a page. The highest level of skipped questions was 6.3%, which meant that 58 of 923 students either skipped or missed a question, while 865 answered the question correctly. Since these surveys were otherwise assessed to have been filled in correctly, with good intent and often providing important insights through the open questions, all of the surveys were included. Comments and answers to the open questions are noted as Student Comment (SC).

Classroom observations and focus group interviews
Other issues related to these themes were also studied through classroom observations and focus group interviews with students in the two classes involved
in the project. The focus group interviews took place at the school and could also be described as informal round-table conversations lasting no more than 20 minutes each. Seven groups (G1–G7) of students were interviewed and the groups were made up of 3–5 students. The themes included in the interview guide, which had been built upon the survey findings, regarded students’ expectations of the uptake and use of digital technologies and the uptake and use in practice in the classroom. The questions examined their own use of computers in the classroom as well as teachers’ use of the computer in the classroom. The observations can mainly be described as my taking on the role as a student in the classroom, taking field notes and gaining information and contextual insight about the initiative through my presence. The field notes were later rewritten in the form of systematic tables including statistics regarding the number of students and computers as well as the theme of the lesson and other additional information. The observations also gave me the possibility to take part in informal conversations documenting uptake and use in practice. The observations comprised 22 lessons, and were distributed across both theoretical and practical subjects in line with the students’ schedules.

**Analysis**

When analysing the results of interview data, Hjerm and Lindgren (2010) recommend a systematic and methodical process for developing codes and themes in interview data. This process involves reading, interpreting, rereading and reflection in an integrated process until the point of saturation. This same process was used for the thematisation of the open questions in the student survey, as well as for the field notes from the classroom observations. The open questions in the survey also provide the possibility to reveal new insights from the perspective of the students regarding their conceptions, experiences and expectations with computers in the classroom (cf. Kvale 2007). In this manner, the uptake and use of laptops as expressed by the students was studied through the text in the survey, the talk in the interviews and actual use through observations of the uptake and use in practice in the classroom. Thereafter, the Ecology of Resources Model and the concept of filters were used for the further interpretation and analysis (Luckin 2010).

**Ethical issues**

This study, with registration number 2011-269-31, was reviewed by the Regional Ethical Review Board of Umeå University, Sweden.

**Findings**

In this section, the findings from the survey, focus group interviews and classroom observations will be presented according to the four empirical themes. Thereafter, how these empirical themes are interpreted or manifested and can be analysed as filters will be presented. Both quantitative and qualitative data are included.
Access to digital technologies at home and a view of the 1:1 initiative

The questions within the first theme regarded computer access at home, broadband and mobile phones. Of the 923 15 to 18-year-olds, namely 409 girls and 514 boys, in this study 97% had access to a computer at home, while 3% did not. Similar figures, 96% and 3%, respectively, were noted for access to broadband, while 1% did not answer. Further, some 910 students, or 99%, reported having their own mobile phone or tablet. Although most students in the focus group interviews had access to computers at home, *I have my own and mom and dad have one and my brother has his own* (G2), another student noted that having access was not the same as *having your own computer* (G7). Regarding students’ view of the 1:1 initiative, the survey showed that some 92% of the students were positive or very positive about the project, while 5% were undecided, the remaining 2% were negative or very negative, and 1% did not answer. Students’ comments ranged from *great* to *unnecessary* (SC).

Use at home and in the classroom

The second theme posed questions regarding how students used digital technologies at home and in the classroom. Some 625 students, or 68%, used their computer at home for school work every day or a few times a week, 26% of them used their computer at home once a month or less, 5% reported never using their computer at home, and 1% did not answer. Students used their computers to surf the Internet for information, to communicate, to take notes, write and edit texts, access online communities, watch live streams and films, read blogs, do online shopping, check the news and listen to music. School work included e-mail-related activity, searching for information, writing essays and other texts.

Overall, 81% of the students were using their computer in the classroom every day or a few times a week, while 13% stated that they used their computer once a month or less, 5% never used it, and 1% did not answer. While some students used the Internet, games and online communities as breaks in classroom activity: *I take a break with my communities* (SC), other students used waiting time efficiently: *During dead time, when the teacher is getting something, or is preparing, I can do fun things* (SC).

In the focus group interviews, one student commented on small breaks: *You take small breaks when you feel like it* (G5). Students also noted that computer use had changed over time: *When you get your computer and not many people had their own computer and it is easier to get games and start to play games and that’s what it was like for four months … during breaks … Now it’s mostly for school work* (G7). The observations showed that, in classroom work in practice, computers were used as soon as free space was provided in the lesson, for example, if the teacher needed to leave the room. These small breaks were taken during lessons, and can be described as simultaneous working with quick breaks.
Other reasons for not using the computer were technical reasons: *It is so slow that I don’t use it* (SC). Other students voiced more personal preferences: *I hate being forced to use a computer* (SC). Why students did not have their computers with them in class was discussed in the focus group interviews. One reason was the computer itself: *It is so heavy* (G7). Another reason was that teachers and students planned ahead, and students therefore could anticipate if the computer was going to be used in the classroom: *Or it just feels like we don’t need it and it is unnecessary to carry it around* (G1). Students also reported that computer use was related to both subjects and teachers: *It depends what the lesson is. You don’t need a computer when you are doing maths, then the computer is just in the way* (G6). This was noted in the classroom observations. Although there were always a few computers which were being repaired, at one lesson more or less all of the students had their computers with them, while at the next lesson the same students appeared without their computers, but were carrying books. This was also noted with regard to use of the computer for taking notes. While many students preferred to take notes on their computer, a number of students chose pencils and paper to take notes in class.

The students were also asked how often they used their computers at school and at home for the Internet, writing, online communities, games and communicating. The results were as follows:

<table>
<thead>
<tr>
<th>Activity</th>
<th>At school (%)</th>
<th>At home (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet, searching for information</td>
<td>44</td>
<td>33</td>
</tr>
<tr>
<td>Writing</td>
<td>43</td>
<td>27</td>
</tr>
<tr>
<td>Online communities</td>
<td>48</td>
<td>64</td>
</tr>
<tr>
<td>Games</td>
<td>23</td>
<td>35</td>
</tr>
<tr>
<td>Communicating</td>
<td>31</td>
<td>49</td>
</tr>
</tbody>
</table>

As for daily use, these students, i.e. for the activities mentioned in Table 1, report more frequent use for the Internet and searching for information and writing at school, while online communities, games and communicating are more frequently used at home. That there is a difference in use at school and at home was expressed by one student: *I don’t bring the computer with me to do fun things!* (SC), while another student wrote: *I never play games on my school computer* (SC). Using different computers for different things was expressed in the focus group interview as students stated that they tended to use the computer at home for things in their spare time: *For pictures from trips and stuff* (G4), and using the school computer for school work: *If I do schoolwork I always use my school computer* (G1). The result of the classroom observations was also in agreement with these findings with regard to the classroom activities noted above.
**Uptake and use in the classroom and ICT skills**

The *third theme* regards self-evaluation questions concerning skills and classroom use of computers. In which ICT skills do students excel? When students self-evaluated their own ICT skills the results were as follows:

Table 2. Students' (N = 923) self-evaluation of their ICT skills

<table>
<thead>
<tr>
<th>ICT use in the classroom</th>
<th>Very good skills (%)</th>
<th>Good skills (%)</th>
<th>Not very good, not at all (%)</th>
<th>No answer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td>80</td>
<td>10</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Chat</td>
<td>81</td>
<td>9</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Presentations</td>
<td>65</td>
<td>22</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Sound</td>
<td>42</td>
<td>29</td>
<td>27</td>
<td>2</td>
</tr>
<tr>
<td>Images</td>
<td>45</td>
<td>27</td>
<td>26</td>
<td>2</td>
</tr>
<tr>
<td>Multimedia</td>
<td>40</td>
<td>31</td>
<td>27</td>
<td>2</td>
</tr>
<tr>
<td>Homepage</td>
<td>28</td>
<td>21</td>
<td>48</td>
<td>3</td>
</tr>
<tr>
<td>Online communities</td>
<td>71</td>
<td>13</td>
<td>13</td>
<td>3</td>
</tr>
</tbody>
</table>

Here, the students regard themselves as having good skills mainly in ICT technologies related to communication such as e-mail, chat and online communities. Skills in technologies for displaying information through presentations, multimedia and homepages were reported to be lower. How were the laptops used in the classroom? A total of 91%, or 848 students, shared the view that computers were used for individual work. Some 5% regarded the use of the computers in the classroom as collaborative, the remaining 3% saw the work with the computer in the classroom as a mix of individual and collaborative work, while 1% did not answer.

According to the students in the focus group interviews, the computers were mainly used for writing assignments, taking notes and making presentations in the classroom: *writing and working goes much faster and flows* (SC). Music was also important: *you can listen to music while working* (SC) or *I concentrate well while listening to music* (SC). The students in the focus group interviews noted that, apart from writing and searching for information, they also used the computer for language skills such as vocabulary, listening and reading in their language classes: *You can use it so much . . . especially in languages* (G4).

The classroom observations also confirmed these findings. For schoolwork, writing, taking notes, making presentations, searching the Internet for information and using vocabulary sites were the most prevalent activities. Although the computers were used for collaborative group projects and presentations, much of the classroom work appeared to be individual work with classroom tasks.

The use of computers in class for activities other than classroom work was reported as follows:
In non-schoolwork activities, online communities were used the most, followed by chatting with friends and playing games the least. Here, students used the computers during class time to play games, visit communities, listen to music and surf the web (SC). These activities were also discussed in the focus group interviews: Sometimes you just don’t have the energy. There are a lot of people in our class who play games. But everyone has to take responsibility for themselves (G5). The classroom observations showed that games, chatting and online communities were part of the students’ activities in the classroom. Moreover, these activities were seen to be more widespread in lessons that were less structured, i.e. the more structured a lesson was, the more non-work activities in the classroom decreased.

**Own learning related to digital technologies in the classroom**

The final and fourth theme, own learning related to digital technologies, posed questions to students regarding whether their use of the computers facilitated school work, made school work more fun or increased their level of responsibility for their schoolwork. A total of 762 of the students, or 83%, in this study believed that use of the computer helped them learn better. While 10% of the students did not think the computer aided their learning, 5% were unsure and 2% did not answer. The notion that computers made work more fun was mainly related to themes of variation, efficiency or adding on to teachers’ content matter: Work methods can be much more variable (SC), It is easier to work efficiently and manage schoolwork (SC) and sometimes teachers’ pedagogy is not sufficient (SC).

The flip side of these possibilities makes up the challenges within this theme, i.e. students’ use of the computer and their responsibility for school work or for other uses: Learning would be just as good without a computer. The computer is a distraction (SC). Another challenge appearing here concerns the role of the teacher in the classroom in helping students who are distracted by other computer activities: Teachers must be more controlling with regard to computers in the classroom so that everyone isn’t just sitting and playing games (SC). Yet another challenge is the lack of ICT skills among teachers, according to the students: Teachers don’t know anything (SC) and Computer courses should be compulsory since computers and the Internet are so important today (SC), pointing to a lack of alignment of ICT skills of the teachers and the students.
The computer seems to make schoolwork more fun, according to 792 students, or 86% of them. While 9% did not think that the computer had any effect on making work more fun, 3% were unsure and 2% did not answer. Students reported that working with a computer was more fun than working with books and paper, easier (SC), provided more possibilities and was stimulating (SC). Other students were more uncertain: It is still just as serious. It is easier, but I don’t think it is more fun (SC).

The last question examined if the students felt that the computer made them feel more responsible for their work. Here 72% felt that work with the computer made them more responsible, while 21% did not agree. The remaining 4% were unsure, and 3% did not answer. As one student noted: I am learning to take responsibility during lessons (SC). Other comments related to responsibility, how the students feel about working with computers. These ideas revolved around a feeling of pride in work, accomplishment and creating their own comfortable working environment: I think that it is good not to have to carry a lot of books, paper, pens and notebooks around. Having a computer that is all that and more is great! (SC). Some students stated they use their computer to create an informal comfortable learning environment: I feel safer when I use my computer at school (SC).

The results of the focus group interviews were in line with these results. According to the students, computers facilitate writing and structure: Instead of writing everything really carefully, I have everything on the computer and everything is saved, instead of a bunch of loose papers (G1), and having access to much more information: You can access so much more information than in books (G5). At the same time, the students note there is a lot of information to be sorted: There is such an incredible amount of information, but how does one know what is best (G6). Students also described work as more efficient, fast and more comfortable (G5). Working with a computer is more fun because it goes faster (G2). However, the computer is a distraction: It is easy to lose focus, people are checking out social media sites and other things during classes. The teacher tells them to close the computer and they put the top down a bit and the teacher gets upset and it takes time. It takes time away from the lesson (G4). A large variation of schoolwork activities and non-schoolwork activities was seen during the classroom observations. Disruptions in classroom work were evident and some students needed the teacher’s help to focus. While some lessons involved no computer use at all, other lessons involved widespread non-classwork computer use, while yet other lessons can be described as fully digitalised in relation to the uptake and use of digital technologies.

**Summary of the findings**

In summary, the four themes provide insights into a number of possibilities, as well as challenges, for TEL through the use of digital technologies. Several possibilities and challenges can be interpreted as manifestations of filters and be of interest for
future work for the students in this 1:1 initiative. The filters which are manifested in these three resource elements, **Environment**, **Knowledge and skills**, and **Tools and people**, will be discussed in the next section of this paper.

**Discussion and Conclusions**

In the light of an Ecology of Resources Model framework (Luckin 2010), the challenges mentioned above can be interpreted as the manifestation of filters as the learner is encompassed in a learning environment in which traditional classroom work methods meet digital technologies. Other filters can be understood within creating *individual and collaborative learning environments* (resource element **Environment**) in the classroom, reducing the *lack of alignment of ICT skills* between the teachers and students (resource element **Knowledge and skills**) as well integrating actual everyday use of computers (resource element **Tools and people**) in the classroom.

**Environment and filters**

The first resource element in the Ecology of Resources Model is **Environment**. The filters here are manifested in tensions between the students creating their own individual learning environments and the classroom environment as an environment for collective, discursive and collaborative learning (also see Lei and Zhao 2008). The students in this study are using their computers to create their own private learning environments. A large number of students say that music is an important part of working, as is taking breaks to visit online communities. For the learner, this pattern of work may have negative effects or impede learning (Holcomb 2009), but it can also illustrate an efficient use of time when used responsibly.

Through their computers students are creating a safe, comfortable environment for learning in which 83% of the students feel that the computer is helping them to learn, 72% feel more responsible for their learning and 86% think it is more fun. Many of these students appear to be using the computer to explore, enrich and expand their learning (Lei and Zhao 2008) as they supplement teachers’ content and pedagogy by accessing and searching for information on the Internet (Silvernail and MLTI 2011). This may be understood as learners taking their learning one step further, moving beyond the teacher’s knowledge, and can perhaps be interpreted as a form of increased learning motivation and involvement. Another possibility appears to be the help that the computer provides in text services such as editing and spelling for students who have difficulties reading and writing. These programs most likely benefit many students as they use their computers for study management, making their schoolwork more efficient and which can be regarded as a form of TEL.

However, in this development, as students create their own learning environments the working environment in the classroom could be understood as a filter. Computers may result in a quiet or calmer classroom (Tallvid and Hallerström...
2009). This may mean that there is peace and quiet to study, but it also means that there is less talk among students. Some 92% of the students in this study state that work with computers in the classroom is individual work, with the remaining 7% seeing such work as collaborative or a mix of both, and 1% not answering. Quiet students working with their own computers may be a sign of increased interest in learning and engagement (Bebell and O’Dwyer 2010), or intense communication with peers and classmates in the virtual world, but it is perhaps more characteristic of work in the traditional classroom than collaborative work through discussion. There is an apparent scenario of students becoming engaged in only one thing, the computer.

Responsibility can also be understood as a filter. As the responsibility for learning is transferred from the teachers to the students, the students must take on this responsibility. While many students can manage this responsibility, many others may need help. Going to school all day is hard work, and breaks are needed. As always, students will take breaks during lessons. Learning to regulate these breaks is also a form of learning and taking responsibility for getting work done (Rockman 2007) as a responsible individual. Allowing students to take responsibility (Apple 2005) for their own learning, engaging them in collaborative work, and helping them to create a learning environment that is task-oriented, which can be understood to be filters for the learner, will be challenges for teachers in the 1:1 classroom.

**Knowledge and skills and filters**

The second resource element is *Knowledge and skills* which refers to filters manifested in the lack of alignment between the teachers’ and students’ ICT skills. The use of new digital tools in long-term traditions and roles in the classroom sharpens the outlook on the deviances in alignment in ICT competence between the teachers and students and makes these problems transparent. When understood as filters, challenges are expected to be found in the technology itself as both students and teachers are forced to keep up with technology. In one sense, the learner has perhaps far more skills than the teacher, and the use of digital technologies in the classroom can be understood as a filter which restrains. In another sense, the learner may lack basic skills which a teacher might take for granted, therefore demanding efforts to improve a learner’s ICT knowledge in certain areas.

The students appear to believe that digital technologies make work more structured and easier, including the possibility of individualisation. This means that they will most likely continue to create their own individual learning environments within the classroom learning environment. According to their self-evaluation, they are good at communicating, visiting online communities and searching for information on the Internet, although they lack skills in more advanced ICT areas such as multimedia.
The information provided on the Internet is up-to-date and authentic. This information from the outside world will also put pressure on teachers’ professionalism to update and restructure their work methods, which requires time and for the learner can be understood as a filter. Continual access to updated information will make students perhaps more demanding in that they will expect this of teachers, and not be satisfied with old material presented in an old manner. This meeting of old and new learning environments is taking place simultaneously as traditional school practices encounter newer work methods and new roles for teachers and students (Somekh 2008). Students as satisfied consumers will shift towards becoming more demanding consumers and, through digital technologies, producers of knowledge. The pride that students experience in being able to produce work with improved quality and layout (Rockman 2007; Holcomb 2009) will increase, and will set demands on teachers’ ICT skills. For teachers, this will mean increasing their own ICT competence to the level of the students and beyond, including the possibility of developing content and ICT knowledge along with students, which takes time (Holcomb 2009). For the learner, this restrains the resources and can be understood as a filter.

For students who use and benefit from more structured work methods through digital materials provided, this may receive increased importance as some students will require more individually adapted solutions, while others will demand more advanced work tasks. For other students who have difficulty taking responsibility for their work in the classroom, the demands on teachers’ ICT skills will also increase as they are forced to make lessons much more interesting than the Internet. This filter may entail the alternative of keeping sharp control over Internet use and related types of classroom order and management. This is perhaps not desirable (Rockman 2007) since this type of class management can be considered to revoke the freedom of the students to think and search freely, constructing their own knowledge and learning environment responsibly. If classroom management does not function, learners can in themselves be analysed as filters for other learners.

Tools and people and filters

The third resource element, Tools and people, and the filters which can be understood here within will perhaps have the largest implications for the uptake and use of digital technologies in the classroom. For the learner in the centre of the Ecology of Resources Model, the laptop is the tool through which TEL is to be achieved with the help of the teacher. According to the students, the reasons for not bringing their computer to the classroom mainly appear to be related to subject-related or teacher-related practicalities. It is important to note that computers may not be necessary in all classes at all times due to an imbalance in subject matter. However, students as learners can be understood as their own filter by not having the technology available in class. In the same manner, a teacher who does
not provide the possibility to access the technology may also be understood as a filter, and similarly a teacher who lacks or has insufficient professional training also manifests a filter. While the teachers have received professional training in line with national initiatives, in order to alleviate this filter more professional training beyond technical issues must be initiated and integrated in a continual process.

As computers are used more often and teachers integrate computers into their teaching, it is most likely that students’ use will also increase. However, in the light of these findings, and noting that this research project is a 1:1 initiative, one major issue is the low ratio of computers used by students in class. When the walls of the classroom are opened through digital technologies, the outside world enters the classroom. Information becomes immediately accessible to students who are given the responsibility for searching for information and creating their own knowledge, of which many opportunities may lead to an increased interest in learning, motivation and engagement (Bebb and O’Dweyer 2010). This will of course be lost if students do not have their computers with them and use them in class. Therefore, the lack of use can be considered to be a filter as well as the lack of well-designed tasks for using the resources. For the learner, a prerequisite for TEL is that 1:1 initiatives have clear objectives and a proper design (Fried 2008).

**Summary of the discussion and conclusions**

When the uptake and use of digital technologies in the classroom is studied in Unos Umeå, students see possibilities in accessing information, managing studies, text skills, and more varied classroom work methods. They also see challenges in focusing on the task at hand, technical problems, and the lack of alignment between students’ and teachers’ ICT skills. These challenges can be interpreted as the manifestation of filters as the learner is encompassed in a learning environment in which traditional classroom work methods and digital technologies meet. In summary, how individual and collaborative learning environments are created in the classroom, the lack of alignment between teachers’ and students’ ICT skills, and how the actual everyday use of computers in the classroom proceeds will have implications for TEL in the classroom.

The concept of filters, as systematic challenges, sheds light on the complexity of the uptake and use of digital technologies in the classroom. These systemic challenges are not easily resolved. However, they spark awareness and possibilities, providing insights into the challenges in practice which students, teachers, school leaders and policy makers face in order to facilitate the uptake and use of digital technologies in the classroom, and therefore driving and pushing TEL in the 1:1 classroom forward for the students and teachers in the Unos Umeå research project and similar research projects internationally.
Future Research
In the future, within the Unos Umeå project it will be interesting to explore how the students’ and teachers’ work with digital technologies in the 1:1 classroom develops and transforms over time. While many findings in this study are in line with previous national and international research, the manifestation of filters expressed in the possibilities and challenges in the uptake and use of digital technologies warrant more in-depth studies. It will be of interest to follow how students make use of digital technologies to enhance, structure and create their own personal learning environments. In addition, the demands students make on teachers regarding professional development in ICT in order to achieve individualisation, collaboration, maintain student focus and create increased possibilities for TEL will also be interesting. Further, the effects on students’ learning and the spinoff effects on the school as an organisation are important questions for future research.

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References


