

# Conditions for Technology Enhanced Learning and Educational Change

A case study of a 1:1 initiative

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*To Dad*

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# Abstract

The uptake and use of digital technologies continues to increase in schools throughout the world. In many schools the uptake and use of digital technologies takes place in One-to-One (1:1) initiatives in which teachers and students have their own laptops. In this thesis the uptake and use of digital technologies is studied from the student, teacher and school leader perspectives in order to through this gain knowledge regarding the conditions for Technology Enhanced Learning (TEL) and educational change in K-12 schools. In the Unos Umeå research project the uptake and use of digital technologies in two schools, an upper secondary school and a compulsory school, was studied. A research design involving a case study approach (Yin, 2003, 2009) was used to study a 1:1 initiative. The methods of data collection were surveys, interviews and classroom observations. To explore, identify and describe conditions for TEL and educational change the data collected were used to map the initial expectations regarding the uptake and use of digital technologies from the start of the initiative as well as to follow the development of teaching and learning activities related to the uptake and use of digital technologies in the 1:1 classroom over a period of two years. The Ecology of Resources Model (Luckin, 2010) was used as a theoretical framework including the use of the concept of filters. Regarding the conditions for TEL, the results show that the uptake and use of digital technologies provides possibilities for new forms of teaching and learning in the 1:1 classroom. Students reported increased motivation, engagement and variation in schoolwork. Teachers described new forms of teaching as well as possibilities for collaboration, sharing of materials and continued professional development. For school leaders possibilities were found in collaboration, administrative support and follow-up of students and teachers, creating a unified vision of the work with digital technologies, and collaboration and sharing within the schools as an ecology of resources. The challenges seen from the student, teacher and school leader perspectives were related to use, technical support and optionality. If the possibilities are to be achieved, there is a need for continued professional development for teachers and school leaders. Further, clear directives through policy will be of importance. In the short term, the practical implications of the uptake and use of digital technologies, specifically in 1:1 initiatives, seem to be strongly connected to sustainability in schools. In the long term, if sustainable conditions for TEL and educational change in the 1:1 classroom can be created and upheld, the practical implications may for example be teachers' improved skills to integrate a thought-through student use of laptops in their teaching practices and an increase in equality of digital competence between students, between schools and between classrooms in the same school.

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Most of all, my thanks go to the students, teachers and school leaders who gave me access to their everyday work at the schools. My dissertation project has involved yet another task for them, among hundreds of things to do in a regular, stressful school day. Without their help and patience, this thesis would not have been possible.

Looking back, my fondest memory of my doctoral studies will be my walks to and from the schools and the university. As I walked along the never-ending rows of birch trees, there was time for reflection. I have thought about the possibilities and challenges related to the uptake and use of digital technologies and of the complexities involved for the students, teachers and school leaders in their day-to-day work. I have considered many of the aspects involved and new questions have evolved and new ideas have come about. I see these questions and ideas as inspiration for continued work.

Umeå, September, 2015

# List of Included Articles

This thesis is based on the following articles, which will be referred to as Article 1 (A1), Article 2 (A2), Article 3 (A3) and Article 4 (A4).

## **Article 1**

Håkansson Lindqvist, M. J. P. (2013). 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. Author's copyright.

## **Article 2**

Håkansson Lindqvist, M. J. P. (in press). Exploring activities regarding technology enhanced learning in a one-to-one initiative. To be published in the *Nordic Journal of Digital Literacy* under the Creative Commons license.

## **Article 3**

Håkansson Lindqvist, M. J. P. (2015). Gaining and sustaining TEL in a 1:1 laptop initiative: Possibilities and challenges for teachers and students. *Computers in the Schools*, 32(1), 35-62. Reprinted by permission Taylor & Francis LLC, (<http://www.tandfonline.com>).

## **Article 4**

Håkansson Lindqvist, M. J. P. (in press). Possibilities and challenges in a one-to-one initiative from a school leader perspective. To be published in *Handbook of Applied Learning Theory and Design in Modern Education* edited by E. Railean, G. Walker, A. Elci and L. Jackson. Copyright IGI Global, [www.igi-global.com](http://www.igi-global.com). Posted by permission of the publisher.

# Introduction

Schools are complex organizations (Berg & Wallin, 1982; Cuban, 2013; Fullan, 2001; Fullan, 2007). The school organization comprises the daily work of teaching and learning in the classroom for students and teachers. For teachers and school leaders, it also includes organizational work related to teaching and learning such as planning, administration, assessment, evaluation and school development. Moreover, practical work in schools takes place in the intersection of European policy recommendations and national laws, policies, rules, recommendations and curricula. Municipalities add on to these documents, with visions and strategies for schools in the local areas.

Swedish school leaders' and teachers' responsibilities for teaching and learning are outlined in the national curricula and subject guidelines. Curricula also outline students' and parents' responsibilities. Students' responsibility for their own work and learning in school, as well as their influence on schools issues, such as school choice and the opportunity to influence the planning of school tasks, has increased (National Agency for Education, 2011a; 2011b). Parents also have expectations about teaching and learning, involvement in school and efforts for educational change (Cuban, 2013; Fullan, 2001). To these can be added the many shifts in pedagogical focus in Swedish schools over the years, from Skinner's behaviorism to Piaget's stages of development and further to today's more sociocultural ideologies inspired by Vygotsky (Säljö, 2000).

Continual efforts to bridge the gap between educational research and practitioners constantly have an impact on schools' efforts to keep up with new research results and the move to a more research-based school for increasing student outcomes and achieving school development (cf. Biesta, 2007; Burkhardt & Schoenfeld, 2003; Olofsson & Lindberg, 2014). In the midst of this complexity, there are perhaps two intentions: the expectation of providing students with the best schooling possible and the need for school development and change to keep up with the educational demands of modern society. Here, the uptake and use of digital technologies has been seen as a way to modernize and reform schools (Olofsson, Lindberg, Fransson & Hauge, 2011; Penuel, 2006; Weston & Bain, 2010).

New digital technologies have rapidly spread through society as a whole and to schools (cf. Selwyn & Facer, 2014). However, they have been slower to gain a foothold in the classroom, with "schools proving slower to change their lesson plan than they were to fit computers in the classroom"

(Livingstone, 2012, p. 9). According to Livingstone (2012), convincing evidence of technology leading to improved outcomes continues to be elusive (cf. Cuban, 2001, 2013; MacGarr, 2009; Säljö, 2010; Topper & Lancaster, 2013). It is difficult to decide what to expect of the new technologies, if they are to be used to support traditional methods of learning in schools or radically new visions of pedagogies based on new skills and digital literacies (Livingstone, 2012). At the same time, the need for students to gain 21<sup>st</sup>-century skills such as critical thinking, problem solving and digital competence in the digitalized classroom is continually emphasized by policy recommendations, such as the European Commission (EC) (EC, 2010) and the Organisation for Economic Co-operation and Development (OECD) (OECD, 2009, 2012).

New technologies as well as educational change have often been connected to hopes for progress in teaching and learning (Cuban, 2001, Lei & Zhao, 2008). These new technologies have involved both possibilities and challenges. From a historical perspective, Williams (2008) refers to teachers' concerns regarding new technologies such as the use of bark, slates, ink, pencils and paper, as quoted in Williams (2008, p. 213):

Students can no longer prepare bark to calculate problems. They depend instead on expensive slates. What will they do when the slate is dropped and breaks? (Teachers Conference, USA, 1703)

Students depend too much upon ink. They no longer know how to use a knife or sharpen a pencil. (National Association of Teachers, USA, 1907)

In the 21<sup>st</sup> century, today's bark, slates, ink, pencils and paper are digital technologies. The rapid uptake and use of digital technologies, or digitalization (Hyllén, 2011; Richardson et al., 2013), has taken place throughout society during the past 10 to 15 years. As in society, the uptake and use of digital technologies has permeated schools and has therefore had an impact on schools (Säljö, 2010). In the move toward digitalized classrooms, students, teachers and school leaders have increasingly supplemented pencils, pens and paper in classrooms with digital technologies such as laptops, tablets, interactive whiteboards and smartphones (Richardson et al., 2013; Valiente, 2010). There appear to be many definitions for the concepts of digital technologies and Information and Communication Technology (ICT), as well as for Technology Enhanced Learning (TEL) (cf. Laurillard & Masterman, 2010) as for enhancing teaching and learning through the use of these technologies. In this thesis, these concepts refer to the uptake and use of laptops, interactive whiteboards

and smartphones, and that involve enhancing teaching and learning through the use of these technologies.

As the uptake and use of digital technologies continues to increase in classrooms throughout the world, teachers and students find themselves working with their own laptops or tablets in the form of One-to-One (1:1) initiatives, meaning one laptop or tablet per student (Richardson et al., 2013; Valiente, 2010). While many of the concerns and challenges are strikingly similar to those noted above in the quotes from Williams (2008), the possibilities for teaching and learning and creating supportive conditions for TEL appear to be strong (cf. Balanskat, Bannister, Hertz, Sigillò & Vuorikari, 2013; Bebell & O'Dwyer, 2010; Lei & Zhao, 2008; Mabry & Snow 2006; Warschauer, 2006). The same can be said for the expectations for new work methods for students, teachers and school leaders through the digitalization of schools (cf. Fullan, 2001). However, compared to previous technologies such as pens and paper, digital technology is said to be “new, ever-changing, expensive, difficult to master, complex to manage, wide-ranging in its potential, disruptive of existing systems” (Laurillard, 2008, p. 144). Furthermore the effects of this technology appear to have an impact on all levels of the school organization, from students, to teachers, to school leaders, and for the school as an organization (Olofsson et al., 2011).

### **European efforts to modernize education through digital technologies**

The need to innovate and modernize education and training is acknowledged in the European 2020 strategy as a way to transform the EU into a competitive economy and to achieve opportunities for work and growth (Bocconi, Kamylyis & Punie, 2013). This work also encompasses providing policies and practices that support modern learning environments (OECD, 2009). These new learning environments involve a holistic approach to ICT in schools, meaning combined efforts from students, teachers, school leaders and policy makers. The importance of ICT in European society is seen as critical for continued development: “It is essential to educate European citizens to use ICT and digital media and particularly to attract youngsters to ICT in education” (EC, 2010, p. 25).

In the digital agenda for Europe, voices are stressing the importance of ICT in education. This involves raising the awareness among educators, parents and policy makers that students need technology and access to digital media and learning. It is also necessary to identify and support the development of 21<sup>st</sup>-century skills and competences through holistic approaches to ICT in education (OECD, 2012). A holistic approach entails policies for the educational use of ICT including “an overall favorable environment, the

inclusion of ICT in curriculum design, and strong leadership from teachers and principals to implement ICT-rich teaching all significantly influence the use of ICT in schools” (p. 39-40). It is hoped that the use of ICT to promote digital skills in the classroom will provide students with 21<sup>st</sup>-century skills (OECD, 2012). In order for students to acquire digital competence, policy recommendations have also put forward the need to increase the use of laptops at school as well as the research on the effects of this use (OECD, 2012).

The use of the concept of digital competence in connection to schools is relatively new, but it has become a key concept in educational policy and research during the last 15 years (Søby, 2013). The skills and competences related to the concept of digital competence comprise several areas: information, communication, content creation, safety and problem solving (Ferrari, 2013). However, the concept also includes a wider scope. Digital competence involves a more integrated and comprehensive approach that involves reflection on the influence of ICT on competences such as communication skills, social skills and critical judgment (Søby, 2013). Further, the concept of digital competence in itself is continually redefined, as it is a “multimodal and complex concept, constantly changing with the development of digital media” (Søby, 2013, p. 136).

There seems to be some consensus regarding what 21<sup>st</sup>-century skills are as well as what teaching strategies can be used for achieving these skills as they are described in policy (Voogt, Erstad, Dede & Mishra, 2013). However, such strategies appear to be difficult to implement in actual educational practice in the classroom (Voogt et al., 2013a). This may mean that many students, despite the intentions of policy, are not developing the ICT skills they need (Voogt et al., 2013a), and teachers and school leaders themselves may need increased levels of skills in using digital technologies in order to support 21<sup>st</sup>-century skills for students (EC, 2010; OECD, 2009).

As the uptake and use of digital technologies increases, so do the expectations for school development and educational change as well as the importance of TEL. However, Europe faces major educational challenges in achieving TEL in general (Fischer et al., 2014) and specifically in K-12 practices (Olofsson, Lindberg & Hauge, 2014). For teachers, it seems that the implementation of ICT involves a shift from technology and tools to pedagogy and learning (Ertmer & Ottenbreit-Leftwich, 2013). Helping teachers with this shift calls for Teacher Professional Development (TPD) in ICT (OECD, 2012). However, providing teachers with necessary skills also appears to be complex, as it requires a shift from a one-size-fits-all model to more individualized TPD that lies closer to the schools (Vrasidas, 2014).

Equipping teachers with skills and opportunities to seek and share expertise in the use of digital technologies (Towndrow & Wan, 2012) also appears to be of importance. Skilled and confident teachers are said to be more important for delivering skills and knowledge in ICT than the latest technology (EC, 2010). School leaders, through their leadership for ICT, also appear to be important in promoting students' and teachers' uptake and use of digital technologies (Dexter, 2008; Williams, 2008). Recognizing the challenges for school leaders in promoting the uptake and use of digital technologies, the OECD (2012) calls for four levels of improving practice: redefining school leadership responsibilities, distributing school leadership, developing skills for effective leading and making the profession of school leader attractive. However, even when the digital resources are accessible, attaining the promotion of students' development of 21<sup>st</sup>-century skills (OECD, 2012) and furthering teachers' activities for the uptake and use of digital technologies in schools takes time (Ertmer & Ottenbreit-Leftwich, 2013; Richardson et al., 2013; Vrasidas, 2014).

### **Efforts in implementing digital technologies in Sweden**

In Sweden, continual efforts have been made over the years to promote the uptake and use of digital technologies in schools. These efforts can be said to have started in the 1980s, with a development that is described as having four waves (cf. Jedeskog, 2005; Perselli, 2015; Tallvid, 2015), all of which were intended to be powerful with long-term effects to carry teachers and school leaders into digitalization whether they wanted to embrace it or not (Jedeskog, 2005). While the initial efforts surrounding the uptake and use of digital technologies mainly comprised stationary computers, later efforts included laptops.

Although there were small projects related to the uptake and use of digital technologies in schools in the 1970s, the Swedish National School Board's presentation of *The Curriculum for Compulsory School (Lgr80)* (National School Board, 1980) in 1980 first highlighted the importance of the computer in teaching. Although some 60% of schools used the funding to purchase a computer developed especially for use in schools called the COMPuter In School or COMPIS (Söderlund, 2000), the use of the computers in teaching did not meet the anticipated goals. At the end of the 1980s the Swedish government decided to implement The Computer and the School (DOS). However, this project did not attain the expected goals either. The top-down format of the project, which did not value teachers' own experiences as important (Hyllén, 2001; Jedeskog, 2005), the low interest among teachers and the lack of computers and experience in using computers in teaching (Jedeskog, 2005) together with high costs (Hyllén, 2011) were seen as the main problems. There were also contradictions

related to confusion regarding whether the teaching activities were to be teaching and learning about the computer or teaching and learning with the use of the computer (Söderlund, 2000).

In the beginning of the 1990s, two major reforms occurred in the educational sphere that had a strong impact on schools throughout Sweden. During 1989-1992, the responsibility for schools shifted from the state to the municipalities. In 1992, the National Agency for Education was established. The newly formed authority was given the task of producing Internet services and databases for schools (Hyllén, 2011). The same year the government, with the aim of increasing Swedish competitiveness abroad, established the Knowledge Foundation (KK-stiftelsen) and gave the foundation the task of supporting the use of digital technologies in schools (Söderlund, 2000). The project involved 27 larger school development projects as best-case scenarios to lead the way (Jedeskog, 2005). This project was an elite effort, and a total of 51 municipalities were offered the opportunity to participate. Despite strong financial support, the challenges related to the project were the time and planning required to develop pedagogy suitable for the uptake and use of technologies (Jedeskog & Nissen, 2004).

The next national effort in the uptake and use of digital technologies was the project Information Technology in School (ITiS). This was historically one of the largest efforts in TPD for teachers, and almost all of the municipalities in Sweden participated. ITiS reached 60% of teachers, or some 75,000 K-12 teachers throughout the country. The project combined TPD and the development of digital infrastructure in schools, and each teacher who participated received his or her own computer (Karlsson, 2004). Compared to earlier projects, ITiS was received well by teachers who participated, most likely because teachers were given time and the opportunity to meet and collaborate with colleagues outside of school and teaching (Jedeskog, 2005). The majority of the teachers felt that they had increased their IT-skills and that collaboration and discussions regarding pedagogical issues had increased (Chaib, Chaib & Ludvigsson, 2004; Jedeskog, 2005; Karlsson, 2004). At the same time, teachers reported that their work on the uptake and use of digital technologies posed demands on differentiating teaching for students as well as having less control over student activities (Chaib et al., 2004). Since the national efforts invested in the ITiS project, only smaller national and municipal efforts have been seen promoting the uptake and use of digital technologies, most likely due the financial crisis that took place in Sweden around the year 2000.

A recent effort to support the uptake and use of digital technologies in Swedish schools was initiated in 2009 by the National Agency for Education. Its goal was to provide TPD with interactive resources and websites to increase teachers' and school leaders' ICT skills. The program, Practical IT and Media (PIM) offered five different levels of ICT competence, of which level 3 was the minimum level recommended by the National Agency for Education. These levels involved creating documents and presentations, and using digital tools such as digital cameras and other digital resources, practical skills for teachers that would support and promote the uptake and use of digital technologies in the classroom with students. It was most likely parallel with this effort that 1:1 initiatives began to be implemented in schools, as schools in Sweden successively were equipped with laptops, wireless Internet and interactive whiteboards (Hyllén, 2014). The PIM-resource was provided free of charge, and teachers could complete the program individually or in collaboration with colleagues. The project was completed by some 150,000 teachers and school leaders (National Agency for Education, 2013a). As of July 1, 2014, PIM was closed down as a result of a decline in interest and the lack of funding (National Agency for Education, 2014).

Once again, in line with the previous governmental reports, in the 2011 national IT-strategy from the Ministry of Enterprise and Innovation, the government stressed schools' responsibility to develop the uptake and use of digital technologies for students in K-12 schools (Ministry of Enterprise and Innovation, 2011). Despite the focus on ICT through policy and recommendations, the Swedish Schools Inspectorate (2011) reported the need to integrate ICT in teaching in a more conscious and structured manner. This meant using ICT to develop both subject-related teaching and students' digital competence. While a strong increase can be seen in access to ICT during the past three years in Sweden, efforts are not as evident in teaching (Swedish Schools Inspectorate, 2012), with use remaining on the same low level and teachers lacking ICT support, equipment and TPD (National Agency for Education, 2013a). A shift to a more conscious and structured integration of ICT in teaching was recommended, in which ICT would be used not just as a replacement for other tools but for development of both subject-related teaching and students' digital competence (Swedish Schools Inspectorate, 2011).

### **Digital technologies and the curricula**

With regard to the uptake and use of digital technologies there are recommendations for school leaders in both the 2011 *Curriculum for the Compulsory School System, the Preschool Class and the Leisure-Time Centre (Lgr11)* (National Agency for Education, 2011a) and the *Curriculum*

for the Upper Secondary School (*Lgy11*) (National Agency for Education, 2011b). In similar formulations in the curricula, school leaders are given responsibility for providing professional development for teachers and for their organizations:

The working environment is organised such that students have access to guidance, teaching material of high quality, as well as other assistance in order to be able to independently search for and acquire knowledge through such means as libraries, computers and other learning aids. (National Agency for Education, 2011a, p. 20)

There are also directives for the uptake and use of digital technologies in the form of goals for students (*Lgr11, Lgy11*) to fulfill. Students must be able to search and evaluate information with digital technologies. The schools' responsibilities for the goals regarding the use of digital technologies are that students:

can use modern technology as a tool in the search for knowledge, communication, creativity and learning. (National Agency for Education, 2011a, p. 16)

and use books, library resources and modern technology as a tool in the search for knowledge, communication, creativity and learning. (National Agency for Education, 2011b, p. 9)

Subject-specific goals for the uptake and use of digital technologies are included for students in certain subjects. However, there are no clear directives or recommendations for teachers. Despite a number of government investigations and publications that have emphasized the importance and the responsibility of schools and teachers' uptake and use of digital technologies, these documents seem not to have had an impact on the curriculum (Hallsén, 2013).

A recent report from the Swedish Digitalization Commission (Official Reports of the Swedish Government, 2014) confirms that the access to technology in schools is good, but the technology is not being integrated as expected in teaching and learning in the classroom, despite the many efforts in 1:1 initiatives. The report acknowledges that Sweden is falling behind with regard to the uptake and use of digital technologies in an international comparison. The commission means that although access to digital technologies has increased, actual use and activities in schools has not. In the classroom, use is mainly related to searching for information on the Internet, writing documents and preparing presentations (National Agency for Education, 2013a). These results echo seminal international research (cf. Cuban, 2001; Cuban, Kirkpatrick & Peck, 2001; Penuel, 2006). Furthermore,

there are differences in technology uptake and use among schools subjects, for example, the use of digital technologies is higher in English than mathematics (Tay, Lim, Lim & Koh, 2012).

Recommendations have been put forth to accelerate the uptake and use of digital technologies in schools through TPD for teachers and school leaders. The introduction of digital competence as a basic skill in the curricula for both compulsory and upper secondary schools is proposed (Official Reports of the Swedish Government, 2104) to promote students' competence in the use of digital technologies. This is also reflected in trends of computer programming classes for students in school (Kafai & Burke, 2015; Lye & Koh, 2014). Further TPD for teachers is also recommended. This trend is reflected in the need for teachers to consider the uptake and use of digital technologies through didactical design (cf. Jahnke & Kumar, 2014; Jahnke et al., 2014; Mor & Winters, 2007; Olofsson & Lindberg, 2014; Selander, 2009) and orchestration (cf. Hauge, 2014; Perotta & Evans, 2013; Öman & Svensson, 2015) in order to enhance student outcomes. Increased skills for school leaders in ICT and in leadership for ICT are also recommended (Official Reports of the Swedish Government, 2104). In the meantime, the National Agency for Education (2013a) reports that the infusion of technology in schools in Sweden continues in the form of 1:1 initiatives. Some 250 municipalities report some form of 1:1 initiative (Taawo, Davidsson & Becker, 2015).

From a Nordic perspective, Norway, Finland, Denmark and Iceland have stronger curriculum recommendations and steering documents for uptake and use of digital technologies than Sweden has (Hyllén, 2011). The importance of the uptake and use of digital technologies in schools is visible in steering documents and curricula. In Denmark and Norway, for example, digital competence is included in the steering documents (Hyllén, 2011). Furthermore, Norway regards digital competence as a basic skill along with reading, writing and math skills (Krumsvik, 2011). Put differently, Denmark, Norway, Finland and Iceland all acknowledge digital competence as an important competence and have supported this in steering documents and curricula. These four countries have national strategies for meeting the competences needed in today's society that support strengthening of the uptake and use of digital technologies (Eurydice, 2012).

Unlike these countries with clear directives, the Swedish government, as shown above, has chosen to support the uptake and use of digital technologies and TEL through national projects (Jedekog, 2005; Perselli, 2014). However, acknowledging the importance of the uptake and use of digital technologies and 21<sup>st</sup>-century skills though curricula does not appear

to be the solution either. Although Norway is placed at the forefront in an international context with regard to ICT infrastructure and use (Søby, 2013), possibilities through the use of ICT are reported to have been insufficiently exploited and are proceeding too slowly. According to research, gaps related to this are time for ICT, competence in ICT, teacher training, insufficient digital learning resources and investments in equipment and infrastructure (Søby, 2013). Yet another gap is the need to support new teachers who enter the teaching profession with sufficient ICT skills to promote the uptake and use of digital technologies in their work in classrooms. These new teachers “straddle the two worlds of the ballpoint pen and the computer mouse” (Fluck & Dowden, 2013, p. 1) and will most likely need to envision their teaching in the digitalized classroom. Otherwise there is a risk that the uptake and use of digital technologies only operates as a relay, reproducing traditional methods of teaching and learning (Player-Koro, 2012).

### **Efforts in the uptake and use of digital technologies in summary**

In summary, the efforts to promote digital technologies in schools in Sweden began in the 1980s. At this time there were three main reasons for promoting the uptake and use of digital technologies: democracy, working life and learning (Jedeskog, 2007). In the 1990s one more reason could be identified: the uptake and use of digital technologies as an agent of change (Jedeskog, 2007). To date, the uptake and use of digital technologies has developed into 1:1 initiatives echoing the possibilities for change as well as school reform (Olofsson et al., 2011; Weston & Bain, 2010). It appears that many aspirations related to the uptake and use of digital technologies continue to be relevant in regard to possibilities for teaching and learning in schools as the access to technology has increased. However, although access to digital technologies has increased, there are no clear signs that the uptake and use of digital technologies for teaching and learning and TEL has increased (Livingstone, 2012; Mor & Winters, 2007). In the effort to provide all students with skills for the 21<sup>st</sup> century, now in the form of 1:1 initiatives in Swedish classrooms, it appears that the challenges of creating the conditions through the uptake and use of digital technologies for teaching and learning and TEL prevail.

In this thesis, the uptake and use of digital technologies and the conditions for TEL and educational change are studied from the student, teacher and school leader perspectives. Two classes in an upper secondary school, one theoretical program and one vocational program, and two classes in a compulsory school that participated in a 1:1 initiative in the Swedish Unos Umeå research project were studied for a period of two years divided into three phases. Starting in 2011, these phases comprised the first or initial

stage (Phase 1), the second phase, some six months after the start of the 1:1 initiative (Phase 2), and the third phase, some two years into the 1:1 initiative (Phase 3). In order to gain insight into initial expectations and activities in regard to the uptake and use of digital technologies, the possibilities and challenges which students, teachers and school leaders face were studied. This was an attempt to gain a deeper understanding of the conditions for TEL and educational change through the uptake and use of digital technologies related to teaching and learning activities in the 1:1 classroom.

The Ecology of Resources Model (Luckin, 2010) was used as a theoretical framework. Using the theoretical concept of filters, possibilities and challenges could be explored, identified and described. Filters could provide insight into the initial expectations regarding the uptake and use of digital technologies in the classroom as well as the day-to-day activities with the uptake and use of digital technologies in the classroom and through this the conditions for TEL and educational change.

### **Aim and research questions**

The aim of this thesis is to explore, identify and describe the possibilities and challenges related to the uptake and use of digital technologies and through this gain knowledge regarding the conditions for TEL and educational change in a 1:1 initiative in two schools over two years. The thesis seeks to examine how expectations and activities related to the uptake and use of digital technologies develop over time with a focus on multiple organizational levels including the student, teacher and school leader perspective. The following two research questions are hereby put forward:

- How can the initial expectations regarding the uptake and use of digital technologies in the classroom be described and be related to the conditions for TEL and educational change?
- Using the Ecology of Resources Model (Luckin, 2010) and the theoretical concept of filters, how can possibilities and challenges in the development of the uptake and use of digital technologies over time be seen in learning, teaching and leadership activities as conditions for TEL and educational change?

### **Structure of the thesis**

Following this introduction, previous research for putting this thesis into context is provided. This section includes a background on uptake and use of digital technologies in Sweden and relevant educational policy. After this background in international and national literature and policy the theoretical framework, The Ecology of Resources Model (Luckin, 2010), is presented.

Following this, the materials and methods as well as the research design involving a case study approach (Simons, 2009; Stake, 1995; Yin, 2003, 2009) are presented. This chapter also provides the local context regarding the research project Unos Umeå and the 1:1 initiative studied at two schools in Umeå, as well as a section about the role of the researcher within this context. Next, a summary of the four articles included in the thesis follows in order to combine the contributions of each study and provide an understanding for the overall analysis. Thereafter the Ecology of Resources Model is used to examine the results of the analysis and the process of the analysis is provided in the chapter Analysis and Discussion. Finally, placing the results and research contribution in a national and international perspective, some conclusions are provided along with suggestions for future research.

### **Research contribution**

The Unos Umeå research project aspires to contribute to the research area of 1:1, TEL and educational change from the student, teacher and school leader perspectives, from both a theoretical and a practical perspective.

From a theoretical perspective, the use of the Ecology of Resources Model (Luckin, 2010) and the concept of filters, aspires to provide a framework for hopefully capturing and illustrating conditions for TEL and educational change through the uptake and use of digital technologies as teaching and learning activities develop over time in the 1:1 classroom. Further, the use of the Ecology of Resources Model in this thesis can be said to be exploratory, by using a model mainly intended for and applied to design in order to explore, understand and identify a wider and deeper understanding of the uptake and use of digital technologies in the classroom.

From a practical perspective, this thesis intends to provide research-based information and recommendations regarding how students, teachers, and school leaders, through the uptake and use of digital technologies, build knowledge through teaching and learning activities in the digitalized classroom. Students' uptake and use of digital technologies will be studied. Teachers' collaboration and sharing of materials as well as TPD will be explored. School leaders' initial expectations and activities related to leadership for supporting the uptake and use of digital technologies will be explored. Moreover, how policy documents affect the work in the classroom in practice and in the school as an organization will be studied. These three actors' perspectives will be combined to provide insight into the possibilities and challenges involved in the uptake and use of digital technologies in practice in the classroom context over time. In other words, they will provide insight into the conditions for TEL and educational change.

# Previous Research

The rapid spread of ICT through society as a whole seems not to have had as strong an impact in the K-12 classroom (Cuban 2013; Livingstone, 2012). Even so, schools have experienced a strong infusion of ICT in order to make the move toward more “process-oriented, constructivistic, and inquiry-based instruction” (Grimes & Warschauer, 2008, p. 306) using the resources available through the Internet. This move also seems to be recommended in policy (EC, 2010; OECD, 2009, 2012). However, this move appears not to have taken place, with “the policy goals being as elusive as ever” (Grimes & Warschauer, 2008, p. 306). It appears to continue to be unclear if the goals are to be used to support traditional methods of learning or to support radically new visions of pedagogies based on new skills and digital literacies (Livingstone, 2012). The aspirations of digital technologies to transform teaching and learning and improve strategies for educational attainment and student outcomes have failed to “conclusively demonstrate significant effects on learning” (Rodríguez, Nussbau & Dombrovskaja, 2012, p. 291). Considering that ICT “was not devised with education in mind, it did not appear naturally in education systems, nor was it demanded by the teacher community” (Rodríguez et al., 2012, p. 292) the gap between uptake and use of digital technologies in society and the classroom might be somewhat easier to understand. In this chapter, previous research will be provided in order to put the thesis into context and to provide deeper insight into the research themes that are relevant for this thesis.

## **Research on the uptake and use of digital technologies and TEL**

Studies within university teaching regarding the uptake and use of digital technologies and TEL have to some extent been challenged and criticized. Many of these studies, as Kirkwood and Price (2014) claim in their article, highlight the variation in the purpose and the ways in which TEL has been understood (Kirkwood & Price, 2014). These studies concentrate on “replicating and supplementing existing teaching” (Kirkwood & Price, 2014, p. 6), while few take on the aim of describing how this is done. Therefore, the researchers continue, the potential of digital technologies to transform teaching and learning practices “does not appear to have achieved substantial uptake, as the majority of studies focused on reproducing or reinforcing existing practices” (p. 6). This transformation of learning can be described as a “complex activity that frequently necessitates reconsideration by teachers of what constitutes ‘teaching’ and ‘learning’” (Kirkwood & Price, 2014, p. 26). This appears to be relevant for all levels of education, both on the university level and in K-12.

Two strands of critique brought up in the research literature on the uptake and use of digital technologies in education are the lack of critical enquiry (Selwyn, 2011; Selwyn 2012) and the limited range of research methods and approaches (Kirkwood & Price, 2014). To reach beyond replicating and supplementing requires formulating the goals of the intervention, designing the evaluation and interpreting the results within the educational context (Lei & Zhao, 2008). Therefore, further research should aim to examine the relationship between these factors and their impact on the potential for the uptake and use of digital technologies as a means to transform the learning experience for the student (cf. Mor & Winters, 2007). Further, Kirkwood and Price (2014) recommend that when TEL studies are conducted in authentic contexts, researchers should examine the assumptions behind the research method and state the limitations as well as the possibility of the findings being generalized to other contexts.

In critiques of research focusing specifically on 1:1 in K-12 such research is sometimes described as broad and somewhat difficult to grasp. For example, Lei and Zhao (2008) put forth that: “The mixed reactions and the controversy on one-to-one computing programs, to a great extent, arise from the lack of empirical evidence on the effectiveness of one-to-one computing on student learning” (p. 100). Penuel (2006) suggests that apart from research in the form of project evaluations, independent research on 1:1 computing is still scarce. According to research, this might be related to the investments in 1:1: “As a high-stake and high profile endeavor, one-to-one computing attracts much attention to the impact of such investments. It is therefore not surprising to see that a considerable amount of studies on one-to-one computing focus on the return of the investment” (Lei & Zhao, 2008, p. 100). The same two researchers continue by stating that studies seldom offer a “broad understanding of the implementation and impact of laptops in classroom” (p. 101), often focusing on the implementation process, but providing little data about how the students actually use their laptops. There appears to be little research concentrating on how laptops are being used for teaching and learning in the classroom in order to provide a deeper understanding of the classroom context (Inan & Lowther, 2010; Lei & Zhao, 2008; Olofsson et al., 2011).

Olofsson et al. (2011) put forth another aspect of the gap in research focusing on the uptake and use of digital technologies in K-12 schools. In their article, they offer three specific suggestions in the research of K-12 schools related to the outcomes of technology use in relation to the different levels of educational systems. The study of educational practices that are longitudinal, and information-rich along with initiatives that would renew theoretical and methodological approaches used for design and analysis is suggested. Here,

the uptake and use of digital technologies refers to both the implementation and the integration of digital technologies and how they are used. According to Olofsson et al. (2011), the concept of uptake and use simultaneously addresses both aspects of digital technologies, “something “in use” and something about “to be used” in perhaps new and changing contexts” (p. 211). Important to note here is that this understanding of uptake and use is adopted in this thesis.

Related to the conclusions drawn in Olofsson et al. (2011) is the research conducted by Underwood and Dillon (2011). They discuss the uptake and use of digital technologies as necessarily involving levels of disturbance in the system and raising the question of “whether the educational system allows itself to be transformed or not” (p. 327). Referring to Crook et al. (2010), Underwood and Dillon (2011) conclude that it may be possible that the educational advantage gained through the use of digital technologies in a single classroom may not persist when implementation is scaled up in classroom contexts. This scenario can potentially lead to certain individuals being left behind:

Failure to embrace technology is unacceptable. If the education system does not forge a new and productive link with technologies other agencies will step in and take their place and they will provide the technology compass. (Underwood & Dillon, 2011, p. 327)

According to DeHondt and Nezlek (2011), this might be why some current research is said to lack evidence that technology enhances the learning process. The researchers further say that “the key to successfully integrating technology into the classroom depends upon the appropriateness of its use, and the specific function it should perform” (p. 11). The uptake and use of digital technologies in the classroom “should be used only when it serves a specific purpose or solves a particular problem. Simply using technology because it is „cool“ or popular results in entertainment rather than lasting educational value” (DeHondt & Nezlek, 2011, p. 12).

In brief, there appear to be challenges related to the lack of critical enquiry, limited research approaches, a somewhat broad understanding and definition of 1:1 and TEL, and the lack of empirical evidence supporting the uptake and use of digital technologies to support learning. It is likely that the continued rapid progress in the development of digital technologies has not made this research easier: “What seems to be major concern is that the notion itself is a moving target in the sense that this evolves rapidly and in line with the appearances of new technologies” (Edelhard Tømte, 2013, p. 76).

## **The uptake and use of digital technologies - ubiquitous computing**

In the days before today's ubiquitous computing, meaning "all students having access to a variety of digital devices and services, including the Internet with all its tools and mobile computing devices, whenever and wherever they need them" (van't Hooft & Swan, 2007, p. 13), practical issues were referred to as a barrier for teachers not implementing technology in the classroom. These challenges were related to the low number of computers per student, such as scheduling shared computer rooms or access to computer carts (Cuban, 2013; Grimes & Warschauer, 2008). However, ubiquitous computing, in the form of 1:1 initiatives "in which all students are provided a laptop for use through the school day, and in most such programs, at home" (Grimes & Warschauer, 2008, p. 306) seemed to have sparked new hopes of overcoming many of the practical challenges for students and teachers in K-12 schools:

Imagine a brave new classroom, one in which technology is neither a subject of study nor a departure from a routine, but rather is as much a part of daily activity as pencils and whiteboards. All students have access to local and worldwide networks and to multiple digital devices, some of which they carry with them and some of which are embedded in the places where they learn. Educational activities are designed to take advantage of external knowledge resources, computer capture of students' work in progress, and nearly effortless communication among students and between students and the instructor. (van't Hooft & Swan, 2007, xxi)

With such a vision in sight, the efforts surrounding the uptake and use of digital technologies through 1:1 continued internationally to increase in strength in practice, and could perhaps best be described as a tsunami (cf. Livingston, 2007). These efforts appear to mirror the development and the aspirations of the uptake and use of digital technologies, seeking the possibilities in the form of 1:1 initiatives in both the United States and the EU. In the literature, 1:1 initiatives are reported to offer benefits such as increased equity in access to technology, the quality of instruction, increased student engagement, academic achievement, digital competence, economic competitiveness and improved connection between the home and school (Penuel, 2006; Rosen & Beck-Hill, 2012). Thus the implementation of 1:1 laptop initiatives can be based on many different motives: learning results, effects on student and teacher collaboration, TPD and organizational issues such as the role of the school leader and policy implementation (Penuel, 2006; Richardson et al., 2013). However, despite the increasing number of 1:1 initiatives around the world, there appears to be limited research in regard to prevalence, scale and scope of research initiatives in 1:1 settings (Richardson et al., 2013).

## **The uptake and use of digital technologies - possibilities and challenges**

In the literature, there are many definitions of what a 1:1 initiative involves. Often 1:1 refers to the same number of devices as students. Whether the device is a tablet, a mobile phone, a handheld computer or a laptop varies. Further, the conditions for 1:1 initiatives in K-12 schools also appear to be somewhat different. While some students have access to the devices only during school time, others have access to the devices both in school and at home. In addition, research reports that in some cases, the device is provided without cost by a company, provided by a school with or without cost, or must be purchased by the parents. The financing of 1:1 initiatives appears to be difficult to capture (Richardson et al., 2013). These somewhat broad and different descriptions with diverse degrees of complexity are said to have made it problematic to interpret the results in terms of more general results, as the results are often based on very different conditions and contexts (Fleischer, 2012; Penuel, 2006) and therefore difficult to transfer to other educational contexts with similar conditions. As noted above, much of the research into 1:1 initiatives has been evaluative in nature (Lei & Zhao, 2008).

Even if a fair number of 1:1 initiatives are reported to be sustainable (Bebell & O'Dwyer; Penuel, 2006; Silvernail & Lane, 2004; Silvernail et al., 2011), there are also challenges put forth in research (Cuban, 2001, 2013; Hu, 2007). Studies show that results relating to laptops in the K-12 classroom may have minimal effects on academic results (Cuban, 2001) and may increase student achievement under certain conditions and in different content areas (Dunleavy & Heinecke, 2007). Other 1:1 initiatives have been shown to lack sustainability and are being abandoned because schools lack the financial resources and staff needed for rigorous evaluation (Hu, 2007). Fried (2008) discusses the unstructured use of laptops in lecture courses and the factors that are associated with laptops interfering with learning. In many classrooms, this has resulted in banning laptops because they “distract students and detract from learning” (p. 906) as well as the focus on promoting appropriate use (Fried, 2008). With appropriate use, meaning use of the laptop as an educational tool, from the research, there appears to be potential for transformative added value in the 1:1 classroom, but it also presents challenges for teaching and classroom management as well as high-quality TPD (Dunleavy, Dextert & Heinecke, 2007).

Cuban (2013) studied a 1:1 initiative in a Bay Area high school in the United States during 1998-1999 and 2008-2010. Using the school's contextual history, interviews and classroom observations, Cuban found that there had been significant changes in students and faculty members, including the

school leader who initiated the 1:1 initiative at the time, which detracted from technology issues. Test scores fell, which put pressure on teachers to choose test-oriented instruction. Teachers' commitment varied, as well as their use of technology, some all the time and others sparingly. Furthermore maintenance costs increased every year, whereas funding was inconsistent. According to Cuban, although the 1:1 initiative began with a good idea, generous funding and enthusiastic school leaders, the technology became an inconsistent activity in the classroom. Even when teachers used the technology they maintained customary pedagogical styles. Cuban's (2013) conclusion was that: "Connections between student achievement and teacher and student use of laptops are, at best, indirect and, at worst, nonexistent" (p. 43).

There appear to be common challenges reported in the literature related to the uptake and use of digital technologies in 1:1, including leadership, vision, funding, TPD and evaluation (Topper & Lancaster, 2013). If these challenges are not understood or accounted for, they may hinder or restrict the potential benefits to be gained (Topper & Lancaster, 2013). In the end, Dunleavy, Dextert and Heinecke (2007) put forth, it is not the laptops per se, but what laptops enable in terms of making possible new methods of teaching and learning that is of importance. It is how students and teachers use technology that will have an impact on learning (Warschauer et al., 2014).

### **The uptake and use of digital technologies and TEL - research on students, teacher and school leaders**

In the following section, the possibilities and challenges surrounding the uptake and use of digital technologies in general, and specifically in 1:1, with a focus on three central perspectives in this thesis - the student, the teacher and the school leader - are presented. It can be said that in the literature so far most of the research conducted in this area seems to have focused on students and teachers whereas research on school leaders has not yet been conducted to the same extent.

#### ***Students***

The motives for implementing digital technologies in the form of 1:1 initiatives for students may be several: improved study results, increased access to computers and therefore equality of technology, becoming better adapted for the work market and improved quality in education (Penuel, 2006). For example, in one of the largest 1:1 initiatives initiated in the U.S. state of Maine, implementation and integration were reported as successful with improved student learning (Silvernail & Lane, 2004). Furthermore, Silvernail et al. (2011) and the Maine Learning Technology Initiative (MLTI)

report that the Maine initiative continues to be successful for student learning, with improved writing, performance in mathematics and science, and ability to locate and evaluate information. Penuel (2006) reports improved results in digital competence and writing. ICT skills for learning, such as use of online research tools, productivity tools, drill and practice, and communication tools were students' most frequent uses of computers in the 1:1 classroom (Dunleavy, Dextert & Heinecke, 2007). In addition, the 1:1 classroom provided the potential for a transformative form of added value (Dunleavy et al., 2007), meaning that the learning process could be enhanced through the uptake and use of digital technologies.

According to Bebell and O'Dwyer (2010), for students, academic results are only one part of TEL environments, as the work with digital technologies may provide opportunities for increased interest in learning and engagement. Along the same line of reasoning, Holcomb (2009) claims that students learning with laptops appear to be more engaged, reflective, and active. Mabry and Snow (2006) report a positive impact on individual research, student responsibility, technical skills and spontaneous collaboration. In research done by Lei and Zhao (2008), results from surveys with students and teachers in a middle school over a period of one year show that laptops may help with tasks involving learning, communication, expression, and exploration. Other research results related to 1:1 initiatives have also shown an increased interest in learning, motivation and involvement (Balanskat et al., 2013; Bebell & O'Dwyer, 2010). Rockman (2007) reports that students experienced a sense of pride and ownership as well as a greater sense of autonomy, independence and responsibility due to the use of laptops. Based on case studies, Warschauer (2006) found that students in 1:1 initiatives improved in the sources, processes and products of their literacy activities.

While 1:1 laptops in K-12 classrooms according to the literature seem to have provided opportunities for student learning, concerns regarding discipline, digital competence, and fear of over-dependency on ICT are also reported (Cuban, 2001; Lei & Zhao, 2008). Non-schoolwork-related use is said to have a negative impact on learning, as "laptop use interfered with students' abilities to pay attention to and understand the lecture material use" (Fried, 2008, p. 911). This impact is described as double, as it affects both the learner and fellow students (Fried, 2008). Kulesza, DeHondt and Nezlek (2011) report how technology increases:

the potential and opportunity for disruption, as well as the potential to spread to others. In the past, students might have been limited to a relatively small number of distractions; however, this number has exploded. A single technological device brings

many more distractions to the classroom now than any other single item. (Kulesza et al., 2011, p. 6)

In some research studies challenges are reported regarding students' use of social media (Andersson, Hatakka, Grönlund & Wiklund, 2014), the lack of educational guidance for Internet use (cf. Blikstad-Balas, 2012) and off-task activities and multitasking (Aagaard, 2015). Student use is further reported to be connected to the aim and design of school tasks: "Students tend to search for information where it is most accessible, and school tasks tend to ask for knowledge about something rather than the deeper and more complex knowledge of something" (Blikstad-Balas & Hristendahl, 2013, p. 43). Lai, Khaddaget and Knezek (2013) put forth that acknowledging students' own learning experiences that are related to TEL as well as allowing the students to bring in informal learning experiences into the classroom, is important to bridge informal and formal learning. However, Lai et al. (2013) mean that this is something that requires educational change in the classroom in order to create increased diversity in teachers' pedagogical approaches. This would provide learning experiences "that better connect students to the real world and the informal learning spaces that they are engaged in out of school" (Lai et al., 2013, p. 421).

### ***Teachers***

Following Perrotta (2013), the expectations regarding teachers' uptake and use of digital technologies are intended to result in enhanced learning outcomes, increased student engagement, and more efficient administration and organization of learning. According to Hixon and Buckenmeyer (2009), however, teachers are often blamed for failing to integrate technology in their teaching, and give such reasons as lack of time, training, equipment, and support. Further, teachers themselves can be considered to be a barrier, instead of a force for change (Underwood & Dillon, 2011). Research on ICT in education reveals that although teachers are gradually starting to integrate ICT into their teaching, significant differences are being observed in the ways ICT is integrated in the K-12 classroom (cf. Tondeur, Cooper & Newhouse, 2010).

It seems that successful technology integration involves more than just having computers in classrooms. Deployment is not enough, according to Warschauer et al. (2014). There appears to be a need to continue to address many challenges that influence teachers' decisions related to the uptake and use of digital technologies in the classroom. Access to resources, incentives to change, support and collegiality in the school, school and national policies, and TPD are of importance. Mumtaz (2000) describes the need to address "three interlocking frameworks for change: the teacher, the school and policy

makers” (p. 319). Simply mandating teachers’ uptake and use of digital technologies does not appear to be useful. Yeung et al. (2012) suggest that a more fruitful approach may be to enhance the competence of teachers in digital technologies as a way to help them see the value of the effectiveness of technologies and gain confidence in applying them in classroom activities. Yeung et al. (2012) continue by saying that teachers need to have successful experiences related to the uptake and use of digital technologies to change their beliefs and classroom practices (cf. Inan, & Lowther, 2010). Teachers’ use of ICT and skills appear to be related (Sipilä, 2014). This also applies to developing pre-service teachers’ competence in the uptake and use of digital technologies and creating a school culture that values such technologies in teaching and learning activities.

How teachers conceptualise teaching and learning with technology appears to have significant and interrelated impact upon their students’ experience of learning (Kirkwood & Price, 2013). Put differently, the uptake and use of digital technologies probably goes beyond just having access to computers. Functional technology integration seems to involve, as often as possible, removing challenges that teachers face with using digital technologies and TEL in their teaching. Hew and Brush (2007) here say that TPD may be used to access many of these internal and external barriers, but that “one-size-fits-all” technology training is perhaps not adequate in light of what can be said to be developmental growth in regard to teachers’ technology use. Successful technology integration calls for more personalized professional development that focuses on teachers’ fundamental beliefs about teaching and learning (Kirkwood & Price, 2013).

Ertmer et al. (2012) studied teachers known for strong technology practices in K-12 classrooms. Results suggested a close alignment between student-centered beliefs and student-centered practices such as authenticity, student choice, and collaboration. Moreover, teachers with student-centered beliefs seemed to enact more student-centered curricula despite technological, administrative, or assessment barriers. This team of researchers concluded that teachers’ own beliefs and attitudes about the relevance of technology to students’ learning were perceived as having the main impact on their success. Teachers participating in the study also indicated that internal factors such as interest and passion for technology or having a problem-solving mentality and support from others, such as administrators and personal learning networks, were important for their practices. In a survey of 683 teachers in 24 secondary schools, Perrotta (2013) studied the complex relationships between teachers’ perceptions of technology-related benefits and a range of individual-, classroom-, school- and system-level issues. Teachers’ beliefs regarding the benefits related to the uptake and use of

digital technologies appear to be influenced more by institutional than individual characteristics. Furthermore, regarding teachers' attitudes about using ICT in education, positive attitudes related specifically to ICT as a useful tool for teaching and learning and a strong sense of self-efficacy in using computers in education seem to influence the use of ICT the most. In contrast, another study suggested that "positive attitudes to ICT generally do not seem to contribute very much to teachers' use of ICT in classrooms" (Player-Koro, 2012, p. 93).

According to Drayton et al. (2010), teachers need TPD as well as time to discuss content, students' work, pedagogy and technology. Ertmer and Ottenbreit-Leftwich (2013) similarly, report that the process of teachers' activities regarding the uptake and use of digital technologies in schools and the shift from technology to pedagogy takes time. These researchers also stress the importance of teachers believing in their own abilities and working in a school culture that embraces a type of TPD intertwining technical, pedagogical and subject-related didactic competences (Ertmer & Ottenbreit-Leftwich, 2010; Kopcha, 2012; Mishra & Koehler, 2006; Voogt et al., 2013b). Towndrow and Wan (2012) emphasize the importance of teachers' collaboration through seeking and sharing. Moreover, Vrasidas (2014) argues that for TPD to work it should be collaborative and situated in teachers' everyday practice. Ertmer and Ottenbreit-Leftwich (2013) put forth that teachers' beliefs of good instruction and learning must be supported by contextual, cognitive and affective factors in school environments if educational change is to take place. Here, the role of the teacher is central (Hattie, 2009). However, the mindsets of teachers must change to include the idea that "teaching is not effective without the appropriate use of information and communication technologies (ICT) resources to facilitate student learning" (Ertmer & Ottenbreit-Leftwich, 2010, p. 255). The importance of the teacher and this relationship to the uptake and use of digital technologies appears to support the idea that: "technology itself is not the agent of change: it is the teacher" (Kirkwood & Price, 2013, p. 336).

### ***School leaders***

With the responsibility of leading for the uptake and use of digital technologies and TEL, the role of the school leader continues to be important. This role can either facilitate or impede complex change (Sheppard & Brown, 2013). While McLeod, Bathon and Richardson (2011) describe the intersection of school leadership and digital technology as using technology to teach in line with the traditional content of educational leadership, Williams (2008) emphasizes the role of school leaders at a time of rapid growth of digital technologies. This includes the challenges of meeting the widening gap between two cultures: the digital youth culture

and the institutional culture found in schools. According to Williams (2008), schools that are more open and responsive to change will most likely also access the knowledge resources available within the community. Furthermore, Williams calls for enterprising leadership that holds a wider perspective of change and preparation for remodelling in order to move from “traditional schooling to the redefined role of a responsive and proactive educational service for the future” (p. 225).

For school leaders, the uptake and use of digital technologies appears to involve additional and new skills. Hayes (2006) studied challenges faced by school leaders who led processes related to the uptake and use of digital technologies, which suggested that school leaders need to develop the skills of so-called new knowledge workers. At the same time, school leaders also have to take part of research that continually reports disappointing results regarding the adaptation and integration of new digital technologies. When studying the effects of digital technology on the leadership role of a group of school leaders, McGarr and Kearney (2009) noted frustration, which was related to the lack of up-to-date resources, poor levels of technical support and the lack of time for the provision of significant technology resources.

In the K-12 school environment, leadership for ICT and school context and culture appear to be important for creating the conditions for the uptake and use of digital technologies and TEL. For example, Dexter (2008) describes school leadership through ICT as important for setting the direction of technology use. In more precise terms, this refers to the support of teachers in practice, offering the possibility to develop ICT skills and therefore move the whole school forward as an organization. Vanderlinde and van Braak (2010) refer to the *e-capacity* of a school. This refers to, for example, a school’s ability to create, optimize and sustain school conditions for effective change through the uptake and use of digital technologies. Here, school leaders are said to be important actors. Other research studies point towards the importance of the school leader’s vision, including the understanding of the role and impact of ICT in the curriculum, and the cultural background as well as the school’s vision (Yuen, Law & Wong, 2003). That schools create a supportive environment for the uptake and use of digital technologies also seems to be important. For example, providing an educational technologist who is both supported by and works together with the school leader, appears to be positively related to the uptake and use of digital technologies (Tondeur et al., 2010). In order to achieve sustainable improvement, school leadership is important for digital technology access as it comprises: “careful planning and skillful orchestration of human, cultural and technological resources” (Hauge, Norenes & Vedøy, 2014, p. 358).

Following Schrum and Levin (2013), school leaders who were efficient in leadership for ICT shared certain characteristics. These school leaders discussed leadership with others, developed support systems for educators, scheduled time for collaboration, vocalized a shared vision, listened to feedback, built partnerships and acknowledged success. Dexter (2008) reported similar findings, presenting key factors that organize leadership practices such as sharing a technology vision, providing instructional support for personnel, aligning technology resources to the curriculum, and ensuring opportunities for teachers to learn, share, and provide input to the leadership team.

Eickelmann (2011) found common factors that may hinder the uptake and use of digital technologies on a school level. These factors are said to be the lack of long-term strategies for integration, the reliance on competent individuals in the organization, the lack of overall support structures and the lack of acceptance among teachers (cf. Kirkland & Sutch, 2009). According to Hatlevik and Arnseth (2012), teachers who experience supportive school leaders are more likely to also experience supportive colleagues and see the benefits of classroom computer use. These teachers may also put more effort into using computers and work with ICT than those who lack school leaders' support. In research reported by Ottestad (2013), school leaders' decisions and beliefs are positively correlated with the time teachers spend using ICT in the classroom and for administrative purposes, the use of common tools and attitudes toward new and student-centered pedagogy, all of which are understood as important in leadership for ICT. For students, Dexter (2008) describes the role of the school leader as vital for students' digital competence. Furthermore, the role of the school leader is to provide technology and engagement as well as clear plans and visions in regard to the use of ICT in practice. Overall, the most important issue in the uptake and use of digital technologies in schools is said to be the presence of informed and effective school leaders (Dexter, 2008).

Lessons learned from implementation specifically in 1:1 initiatives for school leaders (Toy, 2008), or leadership for 1:1, show similar findings as those related to leadership for ICT. These findings also recognize the importance that school leaders use the same technology, are consistent in their support of the decision to implement 1:1 and communicate these expectations clearly (Dexter, 2008). Furthermore, providing the professional development, time and resources needed to support the implementation are also acknowledged, according to Dexter. Other roles which are important for school leaders are supporting early adopters, managing technical issues that interrupt learning with technology as well as supporting the expectations that students' and teachers' work is both done and stored with technology (Toy, 2008). As

studies explore how technologies have been implemented, the subject of leadership emerges throughout the literature on 1:1 initiatives (Kampylis & Punie, 2013). School leaders are considered to be key actors through their leadership. Despite this, they are said to hold little training or competence for making the move from a transformative framework for teaching and learning during a 1:1 initiative toward more systemic change in modern schooling (Kampylis & Punie, 2013). School leaders, the researchers argue, need support in understanding what possibilities and challenges a technology-rich learning environment in school may provide for students and teachers. This also involves support for school leaders in understanding the technological tools used for teaching, learning and administration.

Tondeur, Van Keer, van Braak and Valcke (2008) argue that although the integration of digital technologies influences the entire school as a system, the research that focuses on schools is “generally limited to the study of variables at class level” (p. 296). Studying the integration of digital technologies from a school improvement approach, the local school policy with respect to ICT integration from both the school leader’s perspective and perceptions of teachers was explored along with relationship between school policies and the actual use of ICT in the classroom. Using interviews with 53 primary school leaders and surveys from 574 teachers from the same 53 schools, the local school policy with respect to ICT integration was studied presenting school leaders’ perspectives and teachers’ perceptions. The study of Tondeur et al. (2008) showed that school-related policies, such as an ICT plan, ICT support and ICT training have a significant effect on class use of ICT. In addition, the findings from the interviews in the study indicate that school policies are often underdeveloped and underutilised.

### **Efforts toward 1:1 in the Swedish context**

The first 1:1 initiative in Sweden started in 1996 (Naeslund, 2001). Some 43 million SEK were invested, and students and teachers were given laptops in a compulsory school in Färila. As a case study, the school was followed for three years. The main goal of the 1:1 initiative was to stimulate students’ motivation for learning, facilitate subject integration and promote group work for students of different ages. The positive effects reported from the research were that students showed increased ICT skills and motivation. Furthermore students’ roles as mentors for each other were noted by teachers as being positive for students’ development (Naeslund, 2001). A reported challenge was that work became monotonous for students. The focus on project work and subject integration appeared to lead to a decrease in the level of basic knowledge among students. Moreover, differences increased among students, as students who were already having difficulties faced additional difficulties, while so-called stronger students became even

stronger. According to Naeslund, the 1:1 initiative worked as a catalyst to increase differences between students. Due to a drastic decrease in student results, the project was ended in 2000 (Naeslund, 2001).

The next major 1:1 initiative was initiated in 2007 in the municipality of Falkenberg. In this project, some 60 teachers and some 500 students in two compulsory schools were given laptops in order to increase the motivation and the desire to learn for both students and teachers. According to the project evaluation, motivation increased as a result of the use of the laptops. Students reported increased motivation due to having their own laptops, but they were also more engaged in schoolwork and could produce more professional products, since it was easier to write on a laptop (Tallvid, 2010). A negative trend in grades was seen, and this trend was most likely strengthened through the 1:1 initiative (Tallvid, 2010). At the same time, students experienced having received higher grades and having put more time into homework than previously. The success of the project was said to be based on four factors of success: establishment, management, professional development and freedom as well as strong support from the municipality. Therefore, a main conclusion by Tallvid (2010) was that supporting teachers in creating a TEL environment for students is a concern in 1:1 initiatives that requires a consequent and target-oriented strategy for TPD.

A recent 1:1 initiative in Sweden is the Unos Uno project, which took place in 24 schools in 11 municipalities during 2010-2013. The majority of the teachers and students involved in this project were positive about the 1:1 initiative (Grönlund, 2014; Grönlund, Andersson & Wiklund, 2014; Grönlund et al., 2013). Despite students seeing the possibility of learning being more fun, easier and more efficient, the laptops were also seen as a distraction. The challenges included more work for teachers, an increased level of stress among teachers and students, and increased costs for the schools involved in the project. Furthermore, Grönlund et al. (2013) came to the conclusion that the uptake and use of digital technologies in the Unos Uno project did not have any direct or distinct effects on grades in the schools involved. In 1:1 initiatives, Grönlund (2014) points out the need to go beyond the technology, seeing the uptake and use of digital technologies as leading to a change in teaching and for the school. For a 1:1 initiative and the changes involved to be successful, active and involved leadership is necessary on several levels, from municipal politicians to school leaders. According to Grönlund (2014), the uptake and use of digital technologies in 1:1 initiatives can be considered as projects for school development and educational change.

Another recent study in the Swedish context conducted by Fleischer (2013) discusses how 1:1 affects learning in terms of quality and the conditions for forming knowledge in digitalized school environments. Using a phenomenological approach, this doctoral thesis studied students' and teachers' work in the 1:1 K-12 classroom. Here, 1:1 was reported to stimulate digital competences, related to how to accomplish and produce results, mainly in terms of searching for information and presenting a professional layout. For students, the challenges were according to the study related to stress, distractions and negative effects on communication. Furthermore, this study also showed a gap in discourse concerning social media and actual use. Fleischer (2013) reports that work in the 1:1 classroom may lead to a faster acquisition of knowledge, which is potentially shallower. Fleischer (2013) stresses the need for students to have a "safe starting point while learning on the fast web, catching just-in-time learning opportunities" (p. 107) using the concept of stretched knowledge.

Two other examples of recent 1:1 studies in Sweden are the work of Hansson (2013) and Perselli (2014). Hansson (2013) studied the work with school development and the integration of IT in school through a case study of a compulsory school over a period of three years. In line with Grönlund (2014), Hansson (2013) stresses the need for active and involved leadership for the change related to the uptake and use of digital technologies to have positive effects. Furthermore, it is necessary that there is a learning process among those involved when digital technologies are implemented, if there is to be a sustainable educational change. Focus tends to be on the technologies more than the pedagogy and the school leader hands over the responsibility for the uptake and use of digital technologies to the teachers. This appears to be a difficult task for teachers, as the goals related to the uptake and use of digital technologies often tend to be unclear among teachers, along with the lack of time and support from school leaders for the teachers initiating this work (Hansson, 2013). In a study of the uptake and use of digital technologies in a 1:1 initiative from the teacher perspective, Perselli (2014) studied four teachers' narratives about their views and experiences in teaching using digital technologies in the move from computer rooms to 1:1. This study showed that teachers designed and used their own lived experiences of didactic work and assumptions about students' interest in digital technologies. Teachers' trust and confidence, as well as relationship-building with students were also important. Teachers' experiences were often related to their own interest in the uptake and use of digital technologies. Further, teachers' experiences were also related to the lack of time to learn to use these digital technologies.

Tallvid (2010, 2015) studied the increased uptake and use of digital technologies in the classroom with the aim to describe and explain the consequences and the ongoing change. Based on the evaluation results of longitudinal case studies of two compulsory schools and four upper secondary schools, the impact of 1:1 initiatives on practice in the schools is studied. Using the Technological, Pedagogical and Content Knowledge (TPACK) model, Tallvid (2015) notes that the digitalization of the classroom provides challenges for teachers, but that there is change going on in the classroom. Teachers made five different arguments regarding reluctance to use the laptops for teaching: lack of technical competence, not worth the effort, insufficient material, diminishing control and lack of time all of which were related to technical, pedagogical, and content concerns. Classroom practice is affected in regard to the prerequisites for teaching and how classroom work is designed. However, although technology is changing the classroom practice this does “not automatically mean a change in the overall structure of how education is practiced” (Tallvid, 2015, p. 127). This may mean that studies on a macro level are not sufficient to capture the dynamics at work in the classroom. According to Tallvid (2015), in order for a change to be implemented, the activities in the classroom must first be understood.

In summary, after having gone through a fairly large amount of the research literature, it can be said that it seems as if there are general challenges typically faced by K-12 schools from the student, teacher and school leader perspectives in relation to the uptake and use of digital technologies and the conditions for TEL. These challenges are related to access to resources, the institution, subject culture, beliefs, knowledge and skills, and assessment (Inan & Lowther, 2010; Kew & Bush, 2007; Towndrow & Wan, 2012; Tondeur et al., 2008). Strategies to overcome such challenges include having a shared vision and plan for technology implementation and integration, overcoming the scarcity of resources, changing attitudes and beliefs, providing professional development, and reconsidering assessments (Dexter, 2008; Ertmer et al., 2012; Richardson et al., 2008). With this previous research literature as a base, this thesis will attempt to provide further insight into and deeper understanding of possibilities and challenges related to the uptake and use of digital technologies and the conditions for TEL in teaching and learning activities in the classroom and educational change from the perspectives of the students (Article 1, in this thesis A1), teachers, (Article 2, in this thesis A2; Article 3, in this thesis A3) and the school leaders (Article 4, in this thesis A4). DeHondt and Nezelek (2011) argue that increasing awareness of the challenges related to the uptake and use of digital technologies in the classroom “can help create a mind-set that makes technology an asset to learning rather than a liability” (p. 12). This thesis will try to contribute to that awareness.

# Theoretical Framework

The sociocultural perspective can be described as developmental, regarding learning as an interaction between the individual and her sociocultural environment (Vygotsky, 1978). In the sociocultural perspective, individual activities are considered the means of determining how knowledge, ideas, and practices are incorporated and developed within a context. The activities takes place through interaction and with the use of mediating tools (Vygotsky, 1978; Wertsch, 1998; Engeström, 1987). Activities are framed by a sociocultural context not necessarily similar to other sociocultural contexts. The knowledge and skills developed by the individual through interaction with others are in this perspective understood as due to inherent social and cultural values and ideas in the specific context and can therefore be considered context dependent. In other words, what are seen as relevant or highly valued knowledge and skills in one sociocultural context might be viewed differently in another context. In this thesis, the context in focus is two schools, with the individuals being the students, teachers and school leaders at work in activities related to the uptake and use of digital technologies and TEL as tools for teaching, learning and educational change. In order to gain a deeper understanding about the conditions for the teaching and learning activities that take place in this context, rich data was collected using surveys, interviews and classroom observations. This is an attempt to capture a snapshot to describe this specific context in terms of a longitudinal case study (Simons, 2009; Stake, 1995; Yin, 2003, 2009). The research design was also created with an aspiration to gain insight into the student, teacher and school leader perspectives in the 1:1 initiative by studying the uptake and use of digital technologies and the conditions for TEL in the classrooms over time. In order to understand the possibilities and challenges related to the uptake and use of digital technologies and the activities in the classroom from the learner perspective, the Ecology of Resources Model (Luckin, 2010) was used. The choice of this model was made to provide an illustration of the available resources that was as rich and detailed as possible from the perspectives of the students, teachers and school leaders as well as to attempt to capture the conditions for TEL and educational change.

## **Some considerations regarding the Ecology of Resources Model and its relation to other models**

Beyond the Ecology of Resources Model (Luckin, 2010), other theoretical models to illustrate the uptake and use of digital technologies in similar sociocultural contexts are both available and frequently used in other research studies (Koh & Chai, 2014; Larkin, 2014; Thinley, Geva & Reje,

2014). The Ecology of Resources Model was not the only model considered for use in this thesis. Below, the three most considered of these models are first briefly described, and this is followed by a short reflection in light of the model that, in the end, was put into work in this thesis.

The first example of a model considered for use is the Technological Pedagogical Content Knowledge model (TPACK; Mishra & Koehler, 2006). This model describes the technological, pedagogical and subject-content knowledge needed for teachers to implement digital technologies in their teaching in the classroom. For example, Tallvid (2015) uses this model to capture the complexity of the knowledge and competences needed for teachers working in a digitalized school. TPACK can provide an illustration of the competences needed by teachers in the work with the uptake and use of digital technologies. However, this model mainly seems to be used for the teacher perspective, with the student and school leader perspectives seeming to be absent from this model. In this thesis, the possibility to combine the three perspectives is important, and the use of the Ecology of Resources Model makes this possible in the design of this thesis.

The second example is Laurillard's (2012) Conversational Framework, which can be regarded as both a learning theory and a framework for design. Regarding teaching as a design science, this framework is used to map learning through discussion and collaboration along with the use of technology. This framework maps the learning process through discussion and collaboration, providing a systematic description of this learning process, putting the teacher on one side and the learner on the other side. By studying the teacher's concepts and constructed learning environment, and the student's concepts and specific actions related to work tasks as well as discussion, adaptation, interaction and reflection the learning process can be mapped and designed. This model appears to focus on the learning process and interaction between the teacher and the learner in a combined perspective related to one specific task. The framework appears to be challenging to use in order to capture the perspectives of the students, teachers and school leaders as well as the many various activities that take place in the 1:1 classroom. Furthermore, the Conversational Framework, as suggested by Laurillard (2012), appeared to be difficult to use to capture and illustrate development in activities that take place over time. Such perspectives and development were understood as possible to capture and describe in this thesis through the use of the Ecology of Resources Model.

A third and final theoretical model considered is Activity Theory (Engeström, 2001). This model is often used for capturing the activities in the digitalized classroom (de Lange, 2010; Hansson, 2015). By identifying

the activities that take place in a system and the contradictions between the elements in this system, conflicts and tensions can be made visible. By identifying these conflicts and tensions as manifested in contradictions, possibilities for change may be discovered (cf. Hauge, Lund & Vestøl, 2007; Larkin, 2011; Sipilä, 2014). In this theoretical model, it appears that it is the systems surrounding the learner that are placed at the forefront and not the learner. Further, the use of systems appears to place a distance between the learner in context and the systems surrounding the learner. In this thesis, one aim of the research design was to provide rich description and a contextual, practice-based approach with the focus on the learners in the everyday context, which seemed to be in contrast with these somewhat distanced systems. This is the main reason why the Activity Theory model was put aside in favor of the Ecology of Resources Model.

It should be noted that previously, the Ecology of Resources Model has mainly been used in the design of tasks related to the uptake and use of digital technologies (cf. Luckin, 2007; Luckin, 2008; Luckin, 2010), but there have been some attempts to develop the model further. One such attempt is provided by Häll (2013). Seeing advantages in the model for support and structure in the process of identification, this researcher unites the Ecology of Resources Model with simulation-based medical education as a theoretically strong model of use to both researchers and practitioners. In the thesis at hand, the choice of the Ecology of Resources Model was made because it places the learner in the center, with a holistic view of the resources available to the learner in the specific context. Therefore, the main focus is on the learner, on a collective level, with the attempt to describe the possibilities and challenges as manifested in the empirical data using the theoretical concept of filters related to the uptake and use of digital technologies from the perspective of the learner. For example, for school leaders, the lack of time to prioritize leadership for 1:1 could be said to manifest as a filter from the school leader perspective (A4). For teachers, the lack of time and opportunities for TPD was seen to manifest a filter (A2; A3). The non-alignment of ICT skills between teachers and students could be interpreted as a filter from a student perspective (A1). Therefore, the use of the Ecology of Resources Model in this thesis, placing the learner in the center of the specific context and illustrating the empirical data as manifested in filters from each respective perspective, can be considered to be another, and different, attempt to develop the model.

### **The Ecology of Resources Model**

The Ecology of Resources Model is based on learning as an interaction between the individual and the sociocultural environment (Vygotsky, 1978). It was chosen as a framework that provides the researcher with a theoretical

tool for describing and exploring teaching and learning activities and the support of these activities in the classroom. The Ecology of Resources Model can according to Luckin (2010), be used to design or redesign learning contexts or as a theoretical foundation for improving particular learning contexts or activities. With a holistic view of the learner, acknowledging that the resources available to the learner are closely connected to each other and make up a whole, the model illustrates the learner surrounded by the three resource elements of *Environment, Knowledge and Skills*, as well as *Tools and People*. These resources are said to be available to the learner, and the learner can interact with them directly or indirectly. If the learner is placed in the central position of this learning activity, demands can be set on the surrounding environment, context and design (Luckin, 2010). These three categories of resources have existing relationships and mutual impacts on each other. Moreover, the resources are intertwined and need to be identified, understood and potentially explained to the learner in order to build coherence and support learning. It should be noted that the Ecology of Resources Model is not prescriptive in describing what precise knowledge or skills can be included in the three resource elements (Luckin, 2010). Rather, these elements are a question for investigation through collection and analysis of empirical data. As mentioned above, when referring to examples in the articles included in the thesis, the following will be used: Article 1 (A1), Article 2 (A2), Article 3 (A3) and Article 4 (A4).

### ***Environment***

The first resource element, Environment, comprises the location and the environment, or “the location and surrounding environment with which the learner interacts” (Luckin, 2010, p. 91). It is in the environment that the learning takes place. It could be a workplace, a museum, the home or another environment in which the learner interacts. In this thesis, the context is the classroom context in four classes in the two schools involved in the 1:1 initiative. It is in these contexts that the teaching and learning activities related to the uptake and use of digital technologies take place along with the conditions for TEL and educational change. For example in this resource element, a classroom context with students at work with biology is quite different, compared to the classroom context with students are working to install a new network (A3).

### ***Knowledge and Skills***

The second resource element, Knowledge and Skills, refers to the “stuff to be learnt” (Luckin, 2010, p. 91). This resource element involves all of the knowledge and skills that the learner is expected to learn in the specific context. This element can contain many forms of knowledge and skills, from practical skills to theoretical knowledge. If an area of learning is not well-

defined it is possible that the learner must “understand how the knowledge concepts have been formed and justified in order to understand the nature of the knowledge and the knowledge construction process more generally” (Luckin, 2010, p. 90). In this thesis, the resource element Knowledge and Skills encompasses the knowledge and skills needed to support and promote the uptake and use of digital technologies in the classroom from the student, teacher and school leader perspectives. For example, in this resource element, ICT skills appear to be important to teachers in order to support and provide students with ICT skills (A2; A3).

### ***Tools and People***

The third resource element in the Ecology of Resources Model is Tools and People. This element refers to the tools and people that are available in the learning context. The tools can include digital tools such as laptops and interactive whiteboards, as well as traditional school tools such as books, paper and pens. The people can be students, teachers and school leaders “who know more about the knowledge or skill to be learnt than the learner does” (Luckin, 2010, p. 91). In this thesis, the tools in this resource element are the laptops, the interactive whiteboards, and sometimes smartphones. The people are the students, teachers, and school leaders involved in the uptake and use in the 1:1 classroom context. For example, support from school leaders (people) was seen to be important for the uptake and use of digital technologies (tools) (A4).

### ***Filters as a part of the Ecology of Resources Model***

A central concept in the Ecology of Resources Model is the theoretical concept of *filters*. According to Luckin (2010), the resources available to the learner may be restrained, impeded or enabled. This can be described with the theoretical concept of filters. Luckin means that the process of identifying and studying filters can be used to strengthen the design of and ameliorate the negative effects in technology-rich learning environments (Luckin, 2010). Therefore, identifying and making filters visible can be seen as an important part of identifying the possibilities and challenges related to the uptake and use of digital technologies, as in the case of a 1:1 initiative. Further, by identifying and making filters visible, the filters may be alleviated, thereby facilitating possibilities for TEL and educational change. For example, if technical challenges appear to restrain the uptake and use of digital technologies, the identification of this challenge as manifesting a filter may facilitate the alleviation of this challenge (A1), thereby supporting actual use, and potentially increasing possibilities for TEL and educational change.

The Ecology of Resources Model including the resource elements and filters is provided in Figure 1 below.

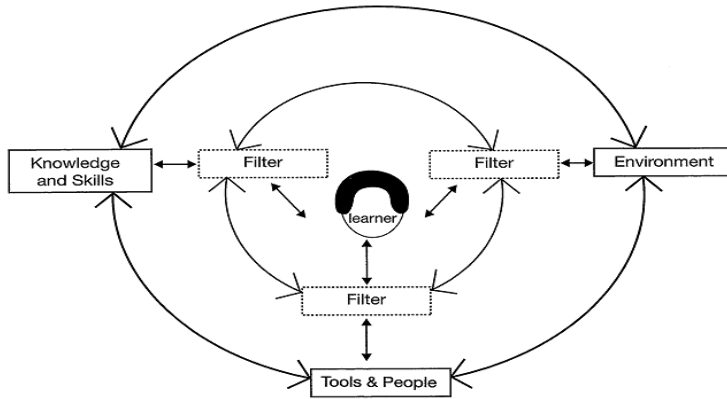


Figure 1. The Ecology of Resources Model (Luckin, 2010). Elements and their filters.

As illustrated above, the learner is placed in the center of the model, surrounded by the resources available to the learner. Luckin (2010) discusses the definition of a learner-centric ecology of resources, noting that by definition it can have only one learner at the center. Therefore, the model becomes a model of the particular learner when the parameters and characteristics of this individual learner are represented. However, according to Luckin (p. 117), the Ecology of Resources Model can be applied to any learner or in terms of a “prototypical learner or a particular category of learner.” In this thesis, the representation of the learner in the center used is this prototypical user who represents the collective or group of learners, such as students, teachers or school leaders. Therefore, the learner at the center does not represent the individual learner but rather the collective of learners. In other words, this could be said to be a collective prototypical learner. Moreover, in this thesis, the learner is seen from different perspectives in the different studies. For example, the school leader perspective is studied in regard to supporting the uptake and use of digital technologies and creating conditions for TEL and educational change (A4). The possibilities and challenges students face are studied (A1) as well as how teachers take on the uptake and use of digital technologies in their everyday work in the classroom (A2; A3). In these studies, students, teachers and school leaders are regarded as learners and the possibilities and challenges related to the uptake and use of digital technologies are analyzed using the theoretical concept of filters. The Ecology of Resources Model illustrates the filters and resource elements made available to the learner at a specific point in time as a snapshot. When using the model as a snapshot at different phases in time, the model can be used to illustrate development over time (A4).

In summary, the Ecology of Resources Model can be considered a way of “simplifying complexity” (Luckin, 2010, p. 166). It is intended to be less abstract than the underlying theory and to construct a bridge between the social scientist’s goal of description and analysis and the computer scientist’s aim to generate design and therefore “to bridge the divide between the social and the technical” (Luckin, 2010, p. 100). The model is not intended “to be a complete and faithful representation of the objective reality of a learner’s context” (Luckin, 2010, p. 111), but a representation of the learner’s sociocultural context, which is sufficient and appropriate. There are often relationships between the resource elements as well as within the resource elements, and the strength of the relationships between the resources, resource categories and filters may vary. However, using the resources in the form of categories for studying the resource elements available, provides a means “to help us identify them and the relationship they bear to the learner and to each other” (Luckin, 2010, p. 91).

### **Considerations regarding the Ecology of Resources Model**

Before moving on to the next chapter, there are some additional considerations to be made about the Ecology of Resources Model itself. As mentioned above, the Ecology of Resources Model places the learner in the center of the model, surrounded by the resources available and the filters that may facilitate or hinder the learner’s access to these resources. In the Ecology of Resources Model, as in all theoretical models, there are always limitations. Here, three issues are of importance to reflect upon: the individual learner at the center, the theoretical concept of filters, and using the model as a series of snapshots in time.

As noted above, Luckin (2010) discusses the definition of a Learner-Centric Ecology of Resources as meaning that a learner-centric ecology of resources can have only one learner at the center. Thus, the model only becomes a model of the learner when the specific characteristics of this individual learner are represented. However, in this thesis, the representation of the learner in the center is a prototypical user who represents the collective of learners, such as students, teachers or school leaders. In this way the learner at the center should not be interpreted as representing the individual learner but the collective of learners. Using the Ecology of Resources Model to represent a prototypical learner or a category of learners, for example, transferring the use of the model from an individual level to a collective level, may entail certain methodological challenges. On the one hand, this collective use may lead to disadvantages in the representation if individual parameters or characteristics are lost in the model. However, on the other hand, the advantage is perhaps that the representation of the learner as a collective is richer, providing a more detailed, but perhaps also

differentiated, view of the category of learners. It may also be that the Ecology of Resources Model for each learner is quite similar. However “each individual group member will have their own individual experiences” (Luckin, 2010, p. 117), which is represented when placing the learner in the center. In this thesis, an attempt has been made to both capture individual experiences as well as to combine the collective or group within the different perspectives.

A central concept in the Ecology of Resources Model, as noted above, is the theoretical concept of filters. According to Luckin (2010), it is by identifying the resources available to the learner and the filters that possibilities and challenges can be identified and alleviated. A filter could hinder access to a resource, which could be alleviated through design. Another alternative could be that the filter does not hinder access sufficiently, in which “the learner is overwhelmed” (Luckin, 2010, p. 121). Here, the filter must be adjusted or tuned to the level of the learner. The choice of the word *filter*, although it is used to express both positive and challenging aspects, could be said to be somewhat challenging as a theoretical concept. A filter, for example in the simple case of a coffee filter, implies a one-way movement. As the coffee trickles down into the pot, there is no going back. However, in the case of the learner, a filter could be said to be a two-way movement. It is possible that filters could be alleviated as well as adjusted to help a learner access resources. On the other side, it also seems possible that the learner could add to a resource. One such example could be a learner who brings knowledge and skills from other contexts into the classroom, where they are used and added on to the resources available. Here, the terms *enabler* or *relay* (cf. Olofsson & Lindberg, 2014) would perhaps be more appropriate as theoretical concepts to capture this two-way movement. Yet another discussion is if it is sufficient to illustrate the theoretical concept of filters through possibilities and challenges alone. However, both of these notions seem to warrant more thought and more empirical work with the model. With this in mind, in this thesis the theoretical concept of filters, comprising both the negative and the positive, is retained as a theoretical concept and used as support for identifying possibilities and challenges that stand between and have an impact on the learner and the resources available. In this sense, the use of the Ecology of Resources Model and the theoretical concept of filters in this thesis can be said to be somewhat exploratory, using a concept from the area of design in order to explore, identify and describe the conditions for TEL and develop a wider understanding of the uptake and use of digital technologies in the 1:1 classroom.

As noted above, the Ecology of Resources Model illustrates the filters and resources made available to the learner at a specific point in time as a

snapshot of the set of elements available. This means that the model illustrates a snapshot of one point in time. However, this also means that as time passes, different snapshots can be combined to show development in activities and resources over time. In this thesis, using a longitudinal approach, such is the case for the perspective of the students, teachers and school leaders. While two snapshots illustrate the development of teachers' activities regarding the uptake and use of digital technologies over a six-month period (A2), three snapshots are used to illustrate the development over time for the school leaders in their work on the uptake and use of digital technologies (A4). Further, it seems possible to combine all of these perspectives to illustrate the possibilities and challenges related to the uptake and use of digital technologies and to gain knowledge regarding the conditions for TEL and educational change.

As a final consideration, what appears to be lacking in the model itself is the school as a complex system of the different learner perspectives in an ecology of resources, with interdependencies between each other. Here, school leaders' activities with digital technologies are understood as having an impact on teachers' activities with digital technologies, which in turn have an impact on students' activities with digital technologies. For example, school leaders' work supporting teacher collaboration (A4) facilitates teachers' collaborative work (A2; A3) and therefore supports teachers' work in the classroom with supporting students' collaborative work (A1). Another example is a school leader who actively works to promote the use of digital technologies, by asking teachers specifically to talk about how they use digital technologies in the classroom to promote students' learning (A4). This question expresses the prioritization of the work on the uptake and use of digital technologies and TEL in the classroom and the follow-up may support use in the classroom. Here, in this elaborated version of the Ecology of Resources Model, the different learner perspectives are tangent to each other, have direct impact on each other, and together push and pull forward, striving toward TEL and educational change. Leaving these thoughts as a base for future work, the next step is to turn to the methodological considerations in this thesis, which are provided in the next chapter.



# **Methodological Considerations - A Case Study Approach**

This chapter describes the research design as well as the materials and methods used in this thesis. This is in order to describe and discuss what was studied, how it was studied, the process of data collection and the analytical process. The research design comprises how the researcher designs and executes the research process (Silverman, 2000). This chapter begins with some considerations and possible challenges in the research process. Following this, the research design and the case study used in this thesis will be described and discussed.

## **Some considerations regarding the research process**

Of importance in the aim of this thesis is to explore, identify and describe the possibilities and challenges related to the uptake and use of digital technologies and through this gain knowledge regarding the conditions for TEL and educational change in a 1:1 initiative in two schools over two years. Considering the fact that the schools involved in the Unos Umeå project have been chosen by the municipality to take part in the research project, it is possible that the students, teachers and school leaders provide an all-too-optimistic view of the uptake and use of digital technologies in the classroom compared to other students, teachers and school leaders in the municipality. The classes were chosen in dialog with the school leaders. This choice may have also involved limitations, in that the school leaders may have chosen teachers and students who were of interest to study. The thesis as a whole in this respect is based on limited data gathered by methods within the sample, the four classrooms in the two schools, which also means that the thesis presents parts of a process and cannot be seen as giving a complete overarching picture.

As a former teacher and school leader, now a student researcher, I have tried to be aware of my prior knowledge and experience of classroom contexts. This prior experience could be considered to involve both possibilities and challenges. Therefore, throughout the research project, I have sought distance and reflexivity, trying to limit my involvement, striving only to observe. With the knowledge that being observed may make people self-conscious and that they may act differently during observation (Patton, 2002), I spent considerable time gaining access to the schools and the classes. After a period of six months or so, I felt that I could come and go at the schools as I felt necessary. Another challenge here was that, when in the classroom, I have felt the risk of becoming too engaged and therefore either not seeing things or drawing hasty conclusions (cf. Bryman, 2008). Although

at times I have become involved, mainly upon the initiative of teachers, I have always tried to be aware of my role as an observer. When this occurred, my reflection instead was perhaps how quickly I could become a non-person to the students in the classes, perhaps better described, as an accepted part of the classroom context. While becoming a non-person provided me with distance, my prior knowledge also seemed to allow me the possibility to access to the classroom context and activities in a rich way.

Yet another challenge was found in what is described as attaining saturation (Glaser & Strauss, 1967). In regard to the observations in the classrooms, I never experienced this point of saturation. Each and every lesson provided new information and new insights, both critical incidents and non-happenings. Here, my experience can be described as “never finished, only left” (Jeffrey & Troman, 2004), as the classroom was a never-ending source of data. It is possible that more time would have led to this point of saturation. However, it was the aspect of the limited time of the research project which led to the end of these observations and this experience. However, in my work with interviews and surveys I did experience this point of saturation. For example, re-occurrences were seen in interviews when teachers expressed the need for time for TPD, which became a theme expressed by teachers in each phase of the research project. My interpretation here was that I had fulfilled the purpose of my fieldwork, at least in regard to the surveys and interviews: “that it should last long enough to get the job done - to answer the research questions being asked and fulfill the purpose of the study” (Patton, 2002, p. 275).

Beyond these challenges, it is also important to note the limitations involved in the collection of data as ethnographic observations (Hammersley & Atkinson, 2007) and in a research design involving a case study approach (cf. Simons, 2009; Stake, 1995; Yin, 2003, 2009). Although surveys, interviews and classroom observations are used as data collection methods, it is impossible to capture all related information, and these methods may also entail a subjective interpretation that is not comprehensive. Nevertheless, the choice of the research design and the methods in this thesis hopefully provide trustworthy knowledge of conditions for TEL through the uptake and use of digital technologies in the 1:1 classroom. Hopefully, this will provide insight in how digital technologies are used in practice by students and teachers, how school leaders organize this work, and the possibilities and challenges involved in this work for educational change.

Just as computing has not been able to provide evidence to support “the dream of comfortable, informed and effortless living” (Rogers, 2006), there is no reason to expect that digital technologies will provide comfortable,

informed or effortless learning, teaching or leadership (cf. Livingstone, 2012; Cuban, 2013). There is a need for a shift in focus from digital technologies to proactive people as ecologies of resources (Dourish, 2001), that instead places the focus on the people in the process. In the schools, these people are students, teachers and school leaders. Although schools as institutions can be seen as complex and somewhat difficult to change, they can also be seen as having an imbedded strength as dynamic and powerful sources of educational change. This may be more about interaction if technology is used to support learning (Luckin, 2010, p. 18). Thus, “the treatment of space and place in educational studies is underexamined, undertheorized and underdeveloped” (Luckin, 2010. p. 17).

### **A case study approach**

In this thesis, the methodological approach regarding the research design of a case study is closely aligned with the sociocultural position and how learning and social practices can be understood within this theoretical position. In this position, another important aspect is context, which in this thesis is the classroom school context. The choice and use of the Ecology of Resources Model as a way to capture the classroom school context over time was also an important part of the research design. A research design involving a case study approach as described in the literature (cf. Simons, 2009; Stake, 1995; Yin, 2003, 2009) appeared to provide the opportunity to combine this theoretical position as well as to capture and demarcate the classroom context. Of interest in this thesis is how teachers and students work together in the activities that occur when laptops are used as mediating tools in the digitalized classroom. Further, how school leaders both use these mediating tools in their leadership and integrate them in their daily work is also of interest. Finally, this study explores how this development takes place collectively as it changes, develops and reproduces through a dynamic process over time (Engeström, 1987; Säljö, 2000; Vygotsky, 1978; Wertsch, 1998).

A research design involving a case study approach can be seen as providing a rich and holistic description, portraying events, contexts, and situation (Cohen, Manion & Morrison, 2011) with the focus being placed on the participants in the study. The case study approach is said to be strong in reality, regarding context as an additional determinant of behavior (Simons, 2009; Stake, 1995; Yin, 2003, 2009). It often involves writing in an accessible style that is immediately intelligible (Cohen et al., 2011). This would imply a form of narrative that “would render the works of science more comprehensible” (Czarniawska, 2004, p. 134-136) and, in respect to this thesis, therefore be somewhat more accessible for a larger sphere of readers.

A case study approach recognizes and accepts complexity, uniqueness, and unpredictability and can permit generalization and application to similar situations (Simons, 2009; Stake, 1995; Yin, 2009). Through different methods of collecting the data in the context and through using different sources of data, the choice of design and methodology are ways for the researcher to avoid determining the empirical findings and conclusions ahead of time (Simons, 2009; Stake, 1995; Yin, 2003, 2009). These methodological insights and suggestions have been followed in this thesis.

The case study as part of a research design is a specific and often unique instance with the potential to illustrate a more general principle (cf. Simons, 2009; Stake, 1995; Yin, 2003, 2009). Stake (1995) describes this as case studies being interested more in particularizations than generalizations. A case study can be described as an instance in action often including direct observation and interviews with an aim of the study to describe and illustrate (Yin, 2003, 2009). In this thesis, a research design involving a case study approach is seen as productive to capture contexts in two schools using multiple units of analysis within the boundaries of a single case study (Stake, 1995; Yin, 2003, 2009).

### **The case study and the three units of analysis**

Yin (2003) discusses several different possibilities regarding the choice of a possible case. This involves what Yin describes as five rationales for choosing a single case. The first rationale involves whether the case can be considered critical or can be used to test a certain theory. The second rationale, is that the case can be said to represent an extreme or unique case. The third rationale is that the case describes a representative or typical case. If the case can be described as revelatory, for example as revealing something previously inaccessible is the fourth rationale. Finally, the fifth rationale is that the case can be studied within a longitudinal design. Of these five rationales (Yin, 2003), the case at hand in this thesis - the case of a 1:1 initiative involving two schools - might be said to align with these five rationales. Although a theory is not tested in this thesis, the use of the Ecology of Resources Model (Luckin, 2010) is an attempt in this direction, which is in line with the first rationale. The case study involves a unique case, as noted in the second rationale. The case, as discussed in the third rationale, may also be said to be representative, as it represents two schools strongly involved in a 1:1 initiative. In line with the fourth rationale, the case study has the intention of revealing new knowledge. Lastly, the case comprises a longitudinal study over two years of a 1:1 initiative.

Further, Yin (2003) describes a research design involving a single case with embedded units of analysis in terms of “when attention is also given to a

subunit or subunits within the single case” (p. 42). This thesis involves a single-case design with three such embedded units of analysis (cf. Yin, 2003, p. 40). The 1:1 initiative involving the two schools is understood as the single case. Within the case of 1:1 lie the three embedded units of analysis. The first unit of analysis is the student perspective, the second unit of analysis is the teacher perspective, and the third unit of analysis is the school leader perspective. The data within each perspective are collected in both schools, providing an aggregated level of analysis for students, teachers and school leaders respectively. This is illustrated in Figure 2 below.

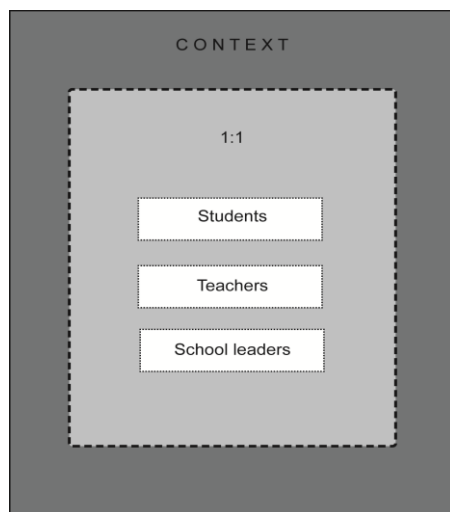


Figure 2. The research design involving a case study approach of the case study of 1:1 and the three embedded units of analysis: students, teachers and school leaders. Adapted from Yin (2003, p. 40).

In summary, the design of this research project is based on the use of a case study approach using a single-case design (Yin, 2003, 2009). This design was chosen to provide a sophisticated, not a comprehensive, understanding of the case (Stake, 1995; Yin, 2003, 2009). Using the student, teacher and school leader perspectives as the three embedded units of analysis in this thesis is an attempt to gain insight into the uptake and use of digital technologies in the case study of 1:1 in the school context and thereby to gain knowledge regarding the conditions for TEL and educational change in two Swedish K-12 schools.

### **Context for the study**

Ethnography can be described as qualitative-based observation of behavior in natural surroundings (Silverman, 2000). This usually involves

observations of people in their daily lives in a specific setting over an extended period of time in a specific context (Hammersley & Atkinson, 2007). The data in ethnographic observations may be comprised of many different sources such as observations, interviews, and documents as well as formal and informal interviews (Hammersley & Atkinson, 2007). In using an ethnographically inspired design in this thesis, the goal was to be able to conduct observations of everyday work in the classroom in depth and over time. Using an ethnographically inspired design gave possibilities to collect empirical data in a systematic manner in order to document and analyze activities in the classroom and how these activities were organized, with the focus on the uptake and use of digital technologies in the classroom (cf. Hammersley & Atkinson, 2007). This type of focus on specific aspects of the context studied is common within ethnographic research and is usually achieved by focusing on cases, events or small groups (Hammersley & Atkinson, 2007) and makes it possible for the researcher to conduct an in-depth and detailed analysis of the context that is being studied.

The Unos Umeå research project in Sweden followed a 1:1 initiative in two schools in the municipality of Umeå in order to study the uptake and use of digital technologies and through this gain knowledge about the conditions for TEL and educational change in K-12 schools. The research project was a joint project between Umeå University and the municipality of Umeå. Therefore, the conditions for doing research in a collaborative project can be described as a two-part balancing act for the researcher. The first act refers to the need for the researcher to balance the possible expectations of the financier, as part of the project has been financed by the municipality of Umeå, and the ethical guidelines for independent research. The second act for the researcher is related to the research project taking place in a municipality that has a relatively small number of compulsory and upper secondary schools, and maintaining the ethical guidelines of anonymity. The name of the research project in itself, Unos Umeå, which was suggested by the municipality, reveals information about the location, making it difficult to achieve anonymity as far as the place of research. At the same time, the need for a thick description (Geertz, 1973) of the context does not make the balancing act easier, as it is rather important for the thesis to describe the case in an as trustworthy and detailed a way as possible, presenting the overarching coherency, as well as the conditions for the thesis. In acknowledging the importance of the ethical guidelines, the Unos Umeå research project was reviewed by the Ethical Review Board in Umeå (Registration number 2011-269-31Ö).

The idea of a joint research project to follow the efforts of the 1:1 initiative in the municipality of Umeå began with a number of representatives, including

the school director, the deputy school director and the head of school development. At the same time, an application was submitted to the national research project, Unos Uno. Unos Uno was initiated in 2011 and followed 1:1 initiatives in 24 schools in 11 different municipalities (Grönlund, 2014; Grönlund et al., 2013). However, the idea of a local research project was further developed into a joint research project with shared financing by the municipality and Umeå University, which in turn meant that it was possible to employ a doctoral student to follow the project. Here, the arguments were that there was a lack of more in-depth and longitudinal research studies with the focus on ICT in schools (cf. Olofsson et al., 2011) in order to carry out a practice-based study. The possibility of combining a longitudinal and practice-based study was further seen as a possibility to capture the central perspectives, such as the students, teachers, school leaders and the schools as organizations. Furthermore, there was a strategic aim; the research results were to be presented to the municipality and the schools throughout the project to benefit the work in the municipality through, for example, seminars for teachers and school leaders.

Following a period of planning of three months during early spring of 2011, the research project was started in the fall of 2011. Two schools were chosen by the municipality to participate in the 1:1 initiative, one compulsory school and one upper secondary school. Which schools were to be chosen or asked to participate in the 1:1 initiative was discussed by the school representatives in the municipality. Both schools to be included were at the forefront in the municipality's 1:1 initiative, which was one reason for choosing them. The choice of schools is never an easy choice, as other schools may feel passed by while others receive extra attention after being chosen for the project. At the time there were several possible schools for the 1:1 initiative, but in the end the municipality had to choose the two schools. Another important factor in the choice of schools was that the profiles of the schools fit both the aims of the research project as well as the aims of the municipality and their intentions with Unos Umeå. Another reason that the municipality chose the two schools was that both schools saw the uptake and use of digital technologies as a way to support teachers' teaching and learning and students' learning. At the start of the research project both schools had educational technologists, three at the upper secondary school and one at the compulsory school, who were involved in the 1:1 initiative and who supported teachers' work in the uptake and use of digital technologies. The educational technologists offered both collegial and individual support for teachers in pedagogical and technical issues through seminars and supervision. Following the choice of schools, the classes and teachers teaching in these classes to be involved were chosen in dialogue with the school leaders. It is also important to note that while the research project

followed the two schools for a period of three years, the data in this thesis were collected during the first two years of the research project, leaving the last year of the data collection for future analysis.

### ***The schools***

The first school that participated in the research project can be described as a large upper secondary school with a central location in the city of Umeå. At the time of the study, there were some 1 200 students and some 133 (53% female) teachers (SiRis, 2014). The students in the two classes that were followed studied two different programs at the upper secondary school. One program was a theoretical program, while the other program was a vocational program.

At the time of the study, there were 29 students (48% girls) in the class in the theoretical program (SiRis, 2014). This three-year study program could be described as highly theoretical. This program involved, apart from languages, civics and sports, a focus on mathematics, biology and physics. The students in the theoretical program were followed for three years. The students in the vocational program were followed for their last two years of a three year program. In this program, first-year students chose different study programs, which meant that the class was divided into several programs after the first year. Of importance to note is that by following the last two years of the program it was possible to follow the same students over time. During the first year of this program, there were 194 students who chose to study this vocational program. In the second year of the program, 12 boys chose to continue in this specific program (SiRis, 2014). Apart from theoretical subjects such as mathematics, Swedish and English, this program offers a number of specific vocational courses, work orientation, work-environment safety courses, and project work as well a lab courses to practice work specific tasks.

The second school that participated in the research project can be described as a middle-sized compulsory school. This school was also located in central Umeå, and at the time of the 1:1 initiative it had some 383 students and 36 teachers (76% female; SiRis, 2014). At the start of the 1:1 initiative, there were 73 students in three grade 7 classes at the school. The two classes that participated in the 1:1 initiative were two of these three parallel classes. In one class there were 26 students (23% girls), and in the other class there were 28 students (46% girls; SiRis, 2014). The students in these two classes in this school were followed from grade 7 to grade 9, the last three years of their compulsory schooling. Both of these classes had home classrooms at the school. This meant that the main part of the students' lessons took place in one classroom.

### ***Technology and training***

Prior to the start of the 1:1 initiative, there had been a previous infusion of technology at the upper secondary school. This infusion meant that teachers as well as students enrolled in certain technical programs at the upper secondary school had previously received laptops in 2006 (Cederblad & Yourstone, 2015). At the compulsory school, teachers received their laptops a year before the students, starting in 2009 (Cederblad & Yourstone, 2015). However, upon the implementation of the 1:1 initiative, the infusion of technology meant that all students in all programs at the upper secondary school received laptops, as did all students in grades 6-9 at the compulsory school. Upon the start of the 1:1 initiative all of the students were asked to sign a contract regulating responsibility and computer use. The students' laptops were theirs to use both in school and at home. At the end of their schooling, students could either return or purchase the laptop. The rules for the use of the laptops and for the return or purchase of the laptop were similar in both schools.

Prior to and upon the start of the 1:1 initiative, teachers were offered professional training through a national ICT training program, Practical IT and Media (PIM), which began in 2009. This training program offered five online modules for teachers to increase their ICT skills, from basic ICT programs to more advanced multimedia programs for use in classroom work with students. At the start of the research project approximately two-thirds of the teachers at both schools had achieved the recommended level (level 3) of ICT training through this program. Interactive whiteboards had been installed in many of the classrooms in both schools, and training for teaching with the interactive whiteboards was provided. At the start of the research project, most classrooms at both schools had interactive whiteboards, but not all. However, by the end of the research project, more or less all classrooms had interactive whiteboards. Training was provided in the form of in-house seminars, workshops on ICT and interactive whiteboards and individual supervision by an educational technologist. At the start of the 1:1 initiative both schools had educational technologists available for teachers who needed technical and pedagogical support in the uptake and use of digital technologies in their teaching. This training, provided at both schools, was characterized by a bottom-up organization, in which teachers who needed help using digital technologies in the classroom could get help with a task. At the start of the research project, the upper secondary school had a Learning Management System (LMS), called Fronter, in use, but the compulsory school did not.

### ***The schools in summary***

In summary, the students in the four classes at the two schools were similar in that they were all participants in the 1:1 initiative and had laptops that they could use both at home and in school. The teachers and school leaders involved in the 1:1 initiative were directly involved in the classes at the schools. While six of the teachers were class mentors in both schools, the other teachers were responsible for teaching the classes in one or more subjects. This meant that at the compulsory school, students met teachers more or less every day and could meet them at other times. At the upper secondary school, students met some teachers only once a week. These similarities provided insight into certain aspects that were common throughout the classrooms at the two different schools, such as the access to interactive whiteboards. However, there were also differences, such as the size of the schools. These differences were related to each school and class amounting to its own specific context.

One main difference between the schools was that they were organized differently, as one school was a compulsory school and the other was non-compulsory. For the non-compulsory school this meant that if a teacher was away for some reason, students were allowed to work at home and the lesson was cancelled, which took place more often at the upper secondary school than at the compulsory school. There were differences in the organization of the schools, subjects, tests, work methods and schedules, all of which had effects on the work in the classroom. This meant that the older students in the non-compulsory school were often given more choices, and were expected to take responsibility for these choices. Another difference was the conditions for the uptake and use of digital technologies in the different program contexts, for example vocational and theoretical programs. These differences resulted in the uptake and use of digital technologies in the vocational program being done somewhat differently than in the theoretical program.

Yet another difference was the age of the students. The students in the upper secondary school were three years older than the students at the compulsory school. However, at the same time, during the 1:1 initiative all of the students grew older and developed, that is to say, they were probably not the same individuals at the start of the 1:1 initiative as at the end of the 1:1 initiative. In this thesis, all of these differences and similarities, add to the empirical data. Together, the combined empirical data hopefully provide a rich and detailed picture of the 1:1 initiative.

## **Data collection methods**

In order to capture information about the uptake and use of digital technologies and to learn more about the conditions for TEL and educational change in each specific school and classroom context several data collection methods were used. These methods were surveys, interviews and classroom observations.

### ***Surveys***

According to de Vaus (2002), surveys can give a brief understanding of digital tools in use but can also relate to overall conceptions, expectations and themes among a group of individuals. When well formulated, surveys provide a convenient source of data are easy for participants to answer and lack interviewer effects (Bryman, 2008). In this thesis, two forms of surveys were used: initial surveys and follow-up surveys. Based on the literature (Silvernail & Lane, 2004; Tallvid, 2010), initial surveys were used to gain insight into the expectations of the students (see Appendix E), teachers (see Appendix F) and school leaders (see Appendix G), involved in the research project at the initial phase of the project. These surveys were tested in a pilot study and slightly revised before being distributed to students and teachers at both schools. The initial survey for school leaders was distributed without a pilot study.

The overall themes involved in the surveys comprised expectations regarding the uptake and use of digital technologies in the classroom, own use, expectations regarding future use and effects on the work in the classroom. The initial survey for the students and teachers at the compulsory school was done online, which was a choice made by the teachers at the school. At the upper secondary school, the students, teachers and school leaders completed the surveys with pens and pencils. Students in both schools were asked questions about use, motivation for schoolwork and responsibility for schoolwork related to the uptake and use of digital technologies. For teachers in both schools the surveys also included questions about expectations, use, expected activities, possibilities and challenges as well as TPD. Similar themes were explored in the surveys which were completed by the school leaders. The follow-up surveys were distributed to and filled out by students at both schools at the end of each term. These surveys were a shorter version of the initial survey and involved uptake and use in practice, motivational issues and expected use in the future. The students filled out these pencil-and-paper surveys at the end of each term. As both the initial surveys and the follow-up surveys comprised open questions, many of the comments noted by the students, teachers and the school leaders in the surveys generated new questions and themes that could be studied further and in

depth through interviews. It was possible to capture questions and themes as the 1:1 initiative progressed over time.

### ***Interviews***

Interviews can be seen as “a key venue for exploring the ways in which subjects experience and understand their world. It provides a unique access to the lived world of subjects, who in their own words describe their activities, experiences and opinions” (Kvale, 2007, p. 9) and makes it possible to enter the other person’s perspective (Patton, 2002). An interview becomes an “inter-view, where knowledge is constructed in the inter-action between two persons about a theme of mutual interest” (Kvale & Brinkman, 2009, p. 2).

Research interviews (Kvale, 2007; Johnson, 2003) were carried out with students, teachers and school leaders at both schools. This provided the opportunity to capture their expectations and activities related to the uptake and use of digital technologies. An interview guide (cf. Patton, 2002) was used in all of the interviews (see Appendix H). However, the interview guide also provided the opportunity to ask other questions and elaborate upon other issues in the interviews. The themes, which were based on the literature, comprised the uptake and use of digital technologies in the classroom, own use and expectations regarding future use as well as possibilities and challenges for work in the classroom. For teachers and school leaders, the interviews further included questions regarding preparation, TPD and leadership.

Teachers and school leaders were interviewed individually while students were interviewed in small groups in the form of focus group interviews (Kreuger, 1994). These interviews took place in small groups of 2-5 students. The groups were decided by the students. Focus group interviews are described in the literature as a beneficial method for identifying major themes, but not subtle differences (Kreuger, 1994). In this thesis, the use of focus group interviews also created a more informal setting for the students who participated, as they had the opportunity to be accompanied by friends in the interview situation.

All of the interviews with the students, teachers and school leaders took place at the schools either in classrooms or in conference rooms. The interviews were digitally recorded and transcribed verbatim by the author or this thesis before analysis.

## ***Observations***

Observation is seen as a reliable research method when collecting information about human activity (Einarsson & Chiriac, 2009). Observations are intended to capture both interactions as well as the contextual understandings for the study. Furthermore, observation offers the researcher access to real situations in natural environments and context (Hammersley & Atkinson, 2007). This data collection method does not solely rely on how people talk about or describe what they are doing, but also on what they in fact are doing. Here, how the observations have taken place and the role of the observer are two important aspects to consider (Patton, 2002).

The observations in this thesis can be described as taking place in a selective intermittent time mode (Jeffrey & Troman, 2004). Jeffrey and Troman refer to this as the observations taking place over a longer period of time. However, there is flexibility in the frequency of the visits. In this thesis, this involved regular visits with the teachers and students in the classes in both schools in every term over a period of two years during the three-year research period. This type of observation offers the possibility to select specific areas of focus as the research develops and progresses (Jeffrey & Troman, 2004). The focus for the observations was based on the literature as well as the initial surveys. In this thesis, the observer's degree of participation can be described as an onlooker observer (Patton, 2002). Here, the researcher took on the role as a student in the classroom. This often meant sitting in the back of the classroom observing what happened and taking field notes, but as noted before, it sometimes meant being more active upon the initiative of the teacher.

Field notes were taken continually during the observations and were later re-written in the form of systematic tables that included descriptive statistics regarding the number of students and laptops, the theme of the lesson, discussions and laptop use. Special note was taken of critical incidents (Tripp, 1993) as uncertain episodes in teaching or significant episodes in a certain context that are not routine occurrences. Focus was also put into what was not happening as "the absence of some particular activity is noteworthy" (Patton, 2002, p. 29). During the observations, informal conversations also came about. These informal conversations were also included in the field notes, as they often gave the researcher the chance to ask questions and check activities and the understanding of the activities in the digitalized classroom.

In summary, surveys, interviews and classroom observations were used in this thesis in order to capture the context of the classroom and the work with the uptake and use of digital technologies in two schools. This was in order

to gain knowledge about the conditions for TEL and educational change. Therefore, the empirical data in this thesis can be said to be threefold, in an attempt to achieve a more complex form of data material and thus a wider understanding of the 1:1 initiative in its specific context. By using different methods, data from one method can help to illustrate and explain from another method (Hammersley & Atkinson, 2007), or in other words, can validate the data by using a combination of data types and cross-checking findings (Patton, 2002). Thus, the uptake and use of digital technologies was studied and validated through text in the surveys, talk in interviews and actual use through observations of the uptake and use in practice in the classroom through triangulation (Hammersley & Atkinson, 2007). How the process of collecting this data was carried out is described in the next section.

### Data collection procedure

The data in this thesis was collected over three phases of a two year period of an overall three-year research project at two schools in central Umeå. As mentioned above, the Unos Umeå project can be regarded as a 1:1 case study with a research design involving a case study approach (Simons, 2009, Yin, 2003, 2009) with three embedded units of analysis. All studies took place within both schools, in two classes in the compulsory school and two classes in the upper secondary school. The emphasis was placed on the possibility of following the students over time in order to study the activities involved in the uptake and use of digital technologies. Therefore, it was also possible to capture the focus on these activities and the development of these activities over time, as non-linear, accumulated development over time. The scope and schedule of the empirical data collected in the research project is presented in Table 1 below.

Table 1. Unos Umeå data collection in total 2011-2013.

Method	Participants	Compulsory school	Upper secondary school	Period of data collection period/phase
Surveys	<i>Initial</i>			
	Students	159	923	Fall 2011 (Phase 1)
	Teachers	25	45	Fall 2011 (Phase 1)
	School leaders	1	3	Fall 2011 (Phase 1)
<i>Follow-up</i>	Students (follow-up)	41	33	Fall 2012 (Phase 3)
		42	35	Spring 2013 (Phase 3)
Interviews	Students (focus group)	7 gr (29)	5 gr (17)	Spring 2012 (Phase 1)
	Teachers (initial)	5	5	Spring 2012 (Phase 2)
	Teachers (follow-up)	5	5	Spring 2013 (Phase 3)
	School leaders (initial)	1	3	Spring 2012 (Phase 2)
	School leaders (follow-up)	1	2	Spring 2013 (Phase 3)
Classroom observations		48 lessons (41 hrs)	22 lessons (26 hrs)	Spring 2012 (Phase 1, Phase 3)
		22 lessons (21 hrs)	13 lessons (14 hrs)	Fall 2012 (Phase 3)
		13 lessons (12 hrs)	8 lessons (10 hrs)	Spring 2013 (Phase 3)

In summary, the empirical data collected in this thesis comprised some 1 370 surveys, 39 interviews and 126 hours of classroom observations. With this data collection overview as a backdrop, the next step is to describe how the data were analyzed.

### **Data analysis**

The work with the data analysis in this thesis can be described as open-ended. It draws upon a wide range of data available to spread light on the questions which are the emerging focus of inquiry (Hammersley & Atkinson, 2007). This resulted in a rich or thick description of the research context of the case (Geertz, 1973; Simons, 2009; Yin, 2003, 2009) which demanded a systematic reduction of the data. The process of analysis can be described in four stages.

The first stage of this process entailed the re-writing of field notes from observations and the open questions from the surveys into systematic tables as well as transcribing interviews. The second stage was to identify topics and themes that could be analyzed in detail. When analyzing the results, Hjern and Lindgren (2011) recommend a systematic process for developing codes and themes in interview data. While coding entails the work of naming the different categories, the thematization process involves the next level. This involves moving from so-called free-floating codes (Hjern & Lindgren, 2011) into an integrated framework of empirical themes. This work involves reading, interpreting, re-reading and reflecting in an integrated process that was repeated until the point of saturation, in which no new themes occurred (Glaser & Strauss, 1967). This entailed moving from the specific empirical base to a more comprehensive picture of each context. An identical process was used for the open data from the surveys and the field notes from the observations. The third stage involved analyzing the empirical categories as the manifestations of the theoretical concept of filters in the Ecology of Resources Model. The fourth stage was to continue to read research literature and connect these results to the body of research in 1:1 and TEL and to begin the writing process in the form of academic articles from the student, teacher and school leader perspectives, thereafter combining these perspectives. The process of reading research literature and writing research articles could be described as parallel. However, these processes were not linear; rather they were continual, intertwined and cumulative. Here, the results were also written as case studies for the schools, noting the similarities and differences between classes and schools, and with each specific case supplementing the case study of the 1:1 initiative. As a part of this preliminary analysis, the results of the analysis were reviewed and discussed with colleagues and the head of the research group in seminars in

the form of a critical friend review (Handal, 1999). This was repeated continually until the analysis process was evaluated as completed.

In summary, each of the articles included in this thesis presents the student, teacher and school leader perspectives at the different time periods or different phases of the research project. An overview of the articles included is presented in Table 2.

Table 2. Overview of articles according to perspective, phase and data methods.

Article	Perspective	Phase	Data method
Article 1 (A1)	Student	I (Fall 2011)	Surveys, focus group interviews, classroom observations
Article 2 (A2)	Teacher	II (Spring 2012)	Surveys, interviews, classroom observations
Article 3 (A3)	Student and Teacher	III (Spring 2013)	Surveys, focus group interviews, interviews, classroom observations
Article 4 (A4)	School leader	III (Spring, 2013)	Surveys, interviews

### **Some considerations regarding reliability, validity and generalization**

Reliability, validity and generalization can be considered criteria for assessing the quality of social research (Bryman, 2008). Reliability concerns the representativeness of empirical findings, while validity concerns the accuracy in displaying the empirical findings and how these findings are analytically accounted for. This would mean that in a study with low reliability, the findings document more or less accidental results, while low validity indicates that the findings misrepresent or alter the context observed in the study. Therefore, the description of the procedure and process from the start of the data collection to interpreting and analyzing the empirical data is important for questions concerning both reliability and validity. This description provides insight and transparency in the research process.

Generalization in research designs involving case study approaches may involve transferal from a single case instance to instances or features of a single case, to the whole of the case, or from a single case to a theoretical extension or theoretical generalization (Cohen et al., 2011). Although the case study approach does not represent a sample, it can be used to “expand and generalize theories” (Yin, 2009, p. 15). Even if strict generalization is not possible, there may be certain transferabilities, since it is “by studying the uniqueness of the particular, we come to understand the universal” (Simons, 1996, p. 231). Here, transferability means that the findings in this thesis are not directly generalizable but can hold certain systematic characteristics

which can be of interest for similar contexts, or in other words, “do the findings apply to other contexts” (Bryman, 2008, p. 34). This means that in activities in the contexts of the case that it is possible to “eventually come to realize the significance of the event, instance or circumstance and the universal understanding that it provokes” (Simons, 1996, p. 231). In this thesis, a case study of a 1:1 initiative regarding conditions for TEL and educational change, the results may be, although not generalizable, perhaps transferable to other similar contexts and therefore may provide new contributions to educational research in practical school contexts as well as classroom work in practice. That this insight can be explored and described through a rich and vivid narrative can also be considered to be yet another advantage of a case study approach, as well as offering the possibility to validate the data material that was collected (cf. Hammersley & Atkinson, 2007; Simons, 2009; Yin, 2003, 2009).

In this thesis, the goal has already from the start of the project been to strive to produce reliable, valid, and, although not generalizable, hopefully transferable findings. This has taken place through the use of pilot studies, data collection methods involving saturation and triangulation and the presentation of findings over time for the schools involved in the research project. Having this goal as a base can make it possible for the findings to be transferable to other similar contexts and for the results of this thesis to be used as a background and provide insight for K-12 schools in similar situations.

### **Ethical considerations**

In ethical considerations in social research, areas of ethical concerns are lack of informed consent, invasion of privacy, deception and harm to participants (Gustafsson, Hermerén & Petersson, 2005; Swedish Research Council, 2011). Informed consent involves the participant’s rights to participate or not in the research project and to receive information about the study. Privacy in research ethics refers to respect for the private individual as well as ensuring that participants as individuals are not recognizable in the findings. This means that confidentiality and anonymity are upheld. Deception entails concerns that the researchers present their work as something other than it is. Finally, the last concern, harm to participants, regards the influence that the researcher has on the participant and his or her participation. Here it is important that the participants are not exposed in a negative way as individuals or as professionals. Another aspect the researcher must take into consideration is exploitation. The participants make themselves accessible to the researcher, but participation can be both time consuming and straining. For example, the time a teacher spends during an interview with a researcher may impinge upon time needed for correcting students’ schoolwork.

In this thesis, all necessary ethical requirements as outlined by the Swedish Research Council (2002; 2011), were considered and followed. Acknowledging the importance the ethical requirements, this project was reviewed by the Central Ethical Review Board of Umeå University (Registration number 2011-269-31Ö).

The students, teachers and school leaders in this thesis were given information about the project and also the ability to participate on a voluntary basis (see Appendix A, Appendix B, Appendix C). The participants were further informed about the data collection methods, how the results were to be presented and that all data collected would be used for research purposes only. The participants were informed about anonymity and confidentiality issues and that all data collected would be stored and made inaccessible to unauthorized individuals. All work was undertaken in a manner that strove to uphold confidentiality and anonymity. The issue of exploitation was especially in focus in this research project, as the methods were used to gain as much information as possible, while at the same time demanding as little time as possible of the students, teachers and school leaders involved. For the younger students in this study, written parental consent forms were used (see Appendix D). While there were many participants who chose to participate in this study, there were students, teachers and school leaders who made an active choice not to participate, which in terms of ethical issues can be interpreted as a result that the information provided regarding the ethical issues of participation was received. Yet another ethical issue in this thesis, as also discussed above, is that the name of the research project itself, Unos Umeå, reveals the location of the study. Although it is also possible for individuals with local knowledge to ascertain which schools are involved, the ethical considerations related to the participants in the research project have had strong priority.

There are also ethical issues involved with role as a researcher. The theoretical base for this thesis is that there are many different understandings of one and the same phenomenon all of which are related to the observers' experiences and social context (Vygotsky, 1978; Wertsch, 1998; Engeström, 1978). In spite of this, knowledge and experience can be understood to be objective from the perspective of the individual (Vygotsky, 1978; Wertsch, 1998). This is also true for the researcher. In this thesis, this has involved the researcher's full respect in the analysis for the views and the dignity of the students, the teachers and the school leaders who have participated.

In the data collection the researcher has been aware of the ethical principles and tried to show the greatest respect for the portrayal of individuals and

their information as well as for all other data involved. In relation to interviews as a data collection method Kvale (2007) means that it is “a delicate balance between the interviewer’s concern of pursuing interesting knowledge and ethical respect for the integrity of the interview subject” (p. 8). What Kvale (2007) puts forth is probably relevant in regard to all data collection methods used in this thesis. It is somewhat difficult for me to judge to what extent I have attained this; however, it has been my goal.

Now leaving these ethical considerations, the next chapter will provide a summary of the articles included in this thesis. For each article, the key findings are presented. These findings are discussed in detail in each of the articles and in the chapter Analysis and Discussion.



# Summary of the Articles

## Article 1

Håkansson Lindqvist, M. J. P. (2013). 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. Author's copyright.

This article presents the findings from the upper secondary school regarding students' uptake and use of digital technologies in the classroom at the start of a 1:1 initiative from a student perspective. The research question posed was the following: *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?* From the student perspective, the possibilities and challenges in the uptake and use of digital technologies and for Technology Enhanced Learning (TEL) are discussed. Using a survey of students (N=923), focus group interviews (N=7) and classroom observations (N=26 hours), the upper secondary school students expressed their expectations regarding the uptake and use of digital technologies in the classroom at the initial stage, Phase 1 (Fall 2011), of a 1:1 initiative. The Ecology of Resources Model (Luckin, 2010) and the theoretical concept of filters were used to analyze the results. For students, the uptake and use of digital technologies involved both possibilities and challenges in schoolwork. Students saw possibilities for accessing information, improving text skills and opportunities for variation in work. They used the laptops to take breaks in class. Students reported creating their own safe, comfortable learning environment, sometimes with music, where they achieved what was described as a flow in work. Overall, students felt that the laptop made them more motivated for schoolwork, made schoolwork more fun and made them feel more responsible for schoolwork. While schoolwork became more structured, according to many students, the schoolwork in the classroom with the laptop also became more isolated. Challenges were seen in focusing on schoolwork, technical problems and the lack of alignment between their skills in Information and Communication Technology (ICT) and teachers' ICT skills. Students also saw the laptop as a distraction, which sometimes made it difficult to focus on schoolwork. They also felt that it was unnecessary to carry the laptop to class when teachers did not encourage use in the classroom. It was concluded that, from the student perspective, how collaborative environments were created, the lack of alignment between teachers' and students' ICT skills and everyday use were seen to be challenges manifested as filters in regard to achieving TEL and educational change in the 1:1 classroom.

## Article 2

Håkansson Lindqvist, M. J. P. (in press). Exploring activities regarding technology enhanced learning in a one-to-one initiative. To be published in the *Nordic Journal of Digital Literacy* under the Creative Commons license.

This article presents the uptake and use of digital technologies and the conditions for Technology Enhanced Learning (TEL) from the teacher perspective at Phase 2 (Spring 2012), some six months into the 1:1 initiative. The following research questions were posed: 1) *How can teachers' expectations regarding the effects of the use of digital technologies and TEL on their work be described?* 2) *What development, if any, can be seen in teachers' activities between Phase 1 and Phase 2?* 3) *How can this development be understood as possibilities and challenges for digital technologies and TEL?* Using a survey (N=25), interviews (N=5) and classroom observations (N=63 hours), compulsory school teachers expressed their expectations, expected activities and activities regarding the uptake and use of digital technologies. Using the Ecology of Resources Model (Luckin, 2010) and the theoretical concept of filters, the results were then analyzed. This study showed how teachers' initial expectations, or expected activities, regarding the uptake and use of digital technologies developed into activities in the classroom. Teachers continued to see possibilities in the 1:1 initiative, realizing the importance of the uptake and use of digital technologies in the classroom. They reported a continued need for Teacher Professional Development (TPD) and time for collaboration as well as technical challenges. One particular challenge teachers faced was helping students focus on classroom work and use the laptops as educational tools for learning. Another important finding in this study was the large variation in teachers' use of Information and Communication Technology (ICT) in the classroom. While some classrooms were almost fully digitalized, others did not involve the use of digital technologies at all. Teachers also reported what appeared to be a development in their teaching activities, which could be interpreted as a development toward more reflective use and an awareness of the pedagogy behind the technology. The need for support from school leaders and policy makers, together with TPD was seen as important for helping teachers to both make the shift from technology to pedagogy in their teaching in the 1:1 classroom and to facilitate learning, TEL and educational change.

### **Article 3**

Håkansson Lindqvist, M. J. P. (2015). Gaining and sustaining TEL in a 1: 1 laptop initiative: Possibilities and challenges for teachers and students. *Computers in the Schools*, 32(1), 35-62. Reprinted by permission of Taylor & Francis LLC, (<http://www.tandfonline.com>).

This article presents the possibilities and challenges of the uptake and use of digital technologies and the conditions for Technology Enhanced Learning (TEL) from the student and teacher perspectives some two years into the 1:1 laptop initiative, or at Phase 3 (Spring 2013) at the compulsory and the upper secondary school. The following research question were posed: 1) *What possibilities and challenges in regard to the uptake and use of laptops can be identified from the teacher and student perspectives?* 2) *What changes, if any, can be identified in the uptake and use of laptops from the teacher and student perspectives in the third phase?* 3) *How can these possibilities and challenges for change and TEL in classroom practice be understood as the manifestation of filters?* In this study, teacher interviews (N=10), student surveys (N=87) and classroom observations (N=124 hours) were used. Teachers and students reported new work methods for teaching and learning in terms of inspiration, assessment, presentation formats and student accessibility. The challenges for students and teachers were seen in technical difficulties, the low uptake and use of the laptops, resistance, the laptops as distractions and the optional use of the laptops. Compared to the initial stage of the 1:1 initiative, Phase 1 (Fall 2011), over time, teachers reported increased teaching activities related to the uptake and use of digital technologies in the classroom and increased collaboration among teachers. Teachers also reported the need for Teacher Professional Development (TPD) as well needing time for TPD. At Phase 3 of the 1:1 initiative, technical problems, continued low laptop use and the lack of planned TPD continued to be challenges, as in the findings in the previous stages. Using the Ecology of Resources Model (Luckin, 2010), the findings in this study highlight the need for skills in Information and Communication Technology (ICT) for teachers and students, the need for TPD for teachers and the need to target laptop use. The practical implications involved were the inherent risk of teachers and students abandoning digital work methods and returning to analogue work methods. This could imply the risk of the loss of creating possibilities for gaining and sustaining TEL and educational change in the two schools in the 1:1 initiative.

#### **Article 4**

Håkansson Lindqvist, M. J. P. (in press). Possibilities and challenges in a one-to-one initiative from a school leader perspective. To be published in *Handbook of Applied Learning Theory and Design in Modern Education* edited by E. Railean, G. Walker, A. Elci and L. Jackson. Copyright IGI Global, www.igi-global.com. Posted by permission of the publisher.

This article discusses the possibilities and challenges of the uptake and use of digital technologies and the conditions for Technology Enhance Learning (TEL) from a school leader perspective in the 1:1 laptop initiative. The following research questions were posed: 1) *What expected activities do school leaders report regarding the uptake and use of digital technologies in school?* 2) *What activities do school leaders report after the first and second year in the 1:1 laptop initiative concerning the work with digital technologies in school, and further what transitions in activities can be identified?* 3) *How can these transitions in activities during the first two years, from Phase 1 to Phase 3, be understood as possibilities and challenges for pedagogical change in school?* A survey, interviews and follow-up interviews with school leaders (N=4) at the upper secondary school and the compulsory school were used to study school leaders' expectations and activities regarding leading for the uptake and use of digital technologies. The school leaders were followed from the start of the initiative, Phase 1 (Fall 2011), to the second phase of the initiative, Phase 2 (Spring 2012), and further to the third stage of the initiative, Phase 3 (Spring 2013). Using the Ecology of Resources Model (Luckin, 2010) and the theoretical concept of filters, the findings were analyzed. The findings showed that the school leaders reported possibilities in new forms of teaching and learning for teachers and students, supporting teachers' work with digital technologies and new methods to follow up with students and teachers. They also reported possibilities in creating digital learning environments for teachers and students, digitally sharing teaching materials, teacher collaboration and their own learning. Challenges were seen in the role of responsibility in teachers' and students' work with digital technologies in the classroom and supporting teachers and students in their work in the classroom. School leaders reported other challenges in creating opportunities for teacher collaboration, the need for increased technical support and developing forms of documenting best practice. Noting the development in the classroom and the shift in teachers' teaching activities from technology to pedagogy over time, it is concluded that increasing school leaders' skills for leading for 1:1 and supporting their leadership for 1:1 will be of importance. Helping school leaders to prioritize leadership for 1:1 was

seen to be important in sustaining school change and the work toward modern digitalized environments and TEL in the 1:1 classroom.



## Analysis and Discussion

The digitalization of society is widespread. Today, digital technologies are present in both working life and during leisure time in many households around the globe. One might even go as far as saying that technologies have become, if not a prerequisite, at least a rather central part, in almost every practice. As probably being one of the most important institutions in society, K-12 schools both in Sweden and internationally have undergone a considerable process of digitalization during the last 15 years (cf. Jedeskog, 2005; Perselli, 2014). In short, the uptake and use of digital technologies and TEL has reached Swedish classrooms in a broad way. It seems no longer optional for students, teachers and school leaders in K-12 schools not to, in one way or another, acknowledge the fact that technologies that have been implemented and integrated and that have changed educational practice in different ways are here to stay. It is most likely that these technologies will change how teaching and learning are designed, arranged and carried out in the classrooms (Grönlund, 2014; Tallvid 2015). That this is the case might, at least in a Swedish context, have become even more apparent in line with the large number of 1:1 initiatives lately being rolled out in K-12 schools.

Now turning focus toward the two schools investigated in this thesis, the uptake and use of digital technologies through the 1:1 initiative appears to be in process. However, while this process seems to be ongoing it is not without obstacles to be overcome and struggles to be dealt with along the way. The results from the empirical studies report hopes that the 1:1 initiative will cultivate TEL, including student learning, such as increased interest in learning, engagement, the development of 21<sup>st</sup>-century skills and digital competence (cf. Balanskat et al., 2013; Bebell & O'Dwyer, 2010; Lei & Zhao, 2008; Mabry & Snow 2006; Warschauer, 2006). However, due to results in this longitudinal study it seems, at the same time, possible to argue that the impact of the 1:1 initiative in the classroom practice perhaps became more complex than what could be expected at the beginning of the initiative (cf. Cuban, 2013; Olofsson et al., 2011; Tondeur et al., 2008). Some of the main results are that despite increased access to digital technologies, students' use seems not to have increased (cf. Cuban, 2013; National Agency for Education, 2013a; Official Reports of the Swedish Government, 2104). Further, the teachers in both schools need time to learn how to use the technology in general and for TPD that combines technology, pedagogy and subject knowledge (cf. Mishra & Kohler, 2006; Tondeur et al., 2000) in particular. Related to this is the result pointing toward the fact that the uptake and use of digital technologies in the K-12 classroom also requires teachers to design thought-through tasks (cf. Hauge, 2014; Perotta & Evans,

2013), which provide opportunities for students to develop deeper subject skills (Fleischer, 2013) and hopefully at the same time some of the 21<sup>st</sup>-century skills pointed out in policy recommendations (EC, 2010; OECD, 2009, 2012). In order to attain these targets, teachers will need continued support from the school leaders (Dexter, 2008; Williams, 2008). While some of the possibilities that have emerged in the results of this study of the Uno Umeå 1:1 initiative have been realized through new work methods for teaching and learning, such as searching for information and presentation formats, challenges still seem to remain. For example, technical challenges prevail as well as the need to support the students' and teachers' uptake and use. There is a need, or in other words, a challenge, on a strategic and operational level, to provide rich possibilities for TPD for teachers and professional development for school leaders. If these challenges are not solved, or at least started to be dealt with, it will most likely be difficult to create conditions for TEL and educational change in the schools as well.

The overall aim of this thesis is, in line with the research questions, to explore, identify and describe the initial expectations and activities of the students, teachers and school leaders as well as to describe the development of the teaching and learning activities over time. Further, it is hoped to contribute to a deeper understanding of the conditions for TEL and educational change over the three phases (2011-2013) of the research project. Using the Ecology of Resources Model and the theoretical concept of filters, an attempt is made in this thesis to understand the development as possibilities and challenges for the uptake and use of digital technologies, TEL and educational change in two Swedish K-12 schools. In answering the research questions, in regard to the uptake and use of digital technologies in the 1:1 classroom in the two schools, the results of the case study consisting of four empirical studies in this thesis, from the student, teacher and school leader perspectives, can be summarized as supporting collaborative learning (resource element Environment), supporting and developing ICT skills (resource element Knowledge and Skills) and increasing the uptake and use of digital technologies (resource element Tools and People). In the following section, these results will be discussed in detail according to the student, teacher and school leader perspective and the three resource elements in the Ecology of Resources Model. When referring to the articles included in the thesis in the following section, the following will be used: Article 1 (A1), Article 2 (A2), Article 3 (A3) and Article 4 (A4).

### **The student perspective**

From the student perspective, it appears that the development over time in students' activities includes isolated use, an element of choice and the need for continued motivation. Technical problems and the need for ICT skills

appear to continue. In summary, the uptake and use of digital technologies in the classroom over time can be illustrated as in Table 3 below.

Table 3. From Phase 1 to Phase 3 in summary - development in students' activities.

Themes	Phase 1 (Fall 2011)	Phase 3 (Spring 2013)
Use	Isolated use Technical problems Actual use and lack of use Focus of tasks	Element of choice Technical problems Actual use and lack of use Teacher use
Own learning	Individual learning Responsibility Need for ICT skills Non-alignment with teachers' skills	Continued motivation Non-school activities Need for ICT skills

When using the Ecology of Resources Model, the development of students' activities over time can be illustrated as in Figure 3 below.

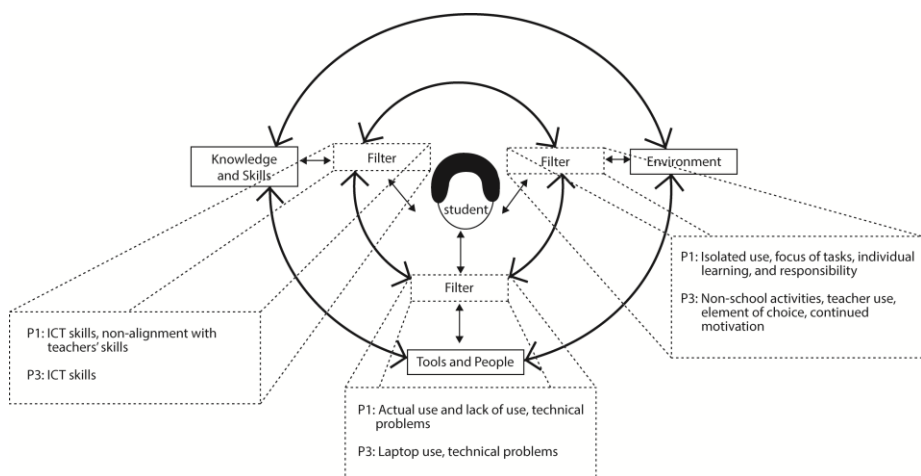


Figure 3. From Phase 1 to Phase 3, the student perspective in summary. The Ecology of Resources Model (Luckin, 2010). Elements and their filters.

In the resource element Environment, students' schoolwork with the laptop appears over time to involve the creation of an individual learning environment. In line with the literature (cf. Bebell & O'Dwyer, 2010; Lei & Zhao, 2008; Penuel, 2006; Rockman, 2007), students participating in this research project report that the laptop makes schoolwork more fun, makes them more responsible, and offers more variation in schoolwork (A1; A2). Although this appears to continue over time, there is a need for continued motivation. This is most likely a consequence of students becoming used to their laptops from Phase 1 to Phase 3, and the realization that the laptop is

for schoolwork. Students also noted that work with the laptop was mainly individual work (A1), which was also a concern expressed by teachers (A2). This individual work can be said to manifest a filter. It may be that individual work is required for a task and is part of the teacher's task design. However, if student work with the laptop is mainly individual work, the possibilities for TEL through creative and collaborative work (cf. Grönlund, 2014; Lei & Zhao, 2008; National Agency for Education, 2011a; 2011b) will most likely be difficult to achieve.

Supporting students in developing 21<sup>st</sup>-century skills will be important as well as providing them with basic ICT skills that are specifically related to schoolwork and using the laptop as an educational tool. Therefore, in the resource element Knowledge and Skills, the lack of these skills could be said to manifest a filter. The students who participated in this 1:1 initiative in both schools did not receive any form of formalized introduction in basic ICT skills, although many of them reported the need for both basic and more advanced ICT skills (A1). While students reported increased skills in ICT over time from Phase 1 to Phase 3, they interestingly enough also reported what could be interpreted as low use of the laptops (A1; A3). While students reported that teachers did not use the laptops in lessons (A1; A3), they also reported technical problems with the laptops and that they were heavy to bring to lessons (A1; A3). This could mean that the ICT skills students gained were acquired outside the classroom, perhaps through informal educational contexts rather than the formal classroom context.

Students also reported a lack of alignment between teachers' and students' ICT skills (A1). It is possible that many of the students, when receiving their laptop, had the basic ICT skills necessary for schoolwork. This may also mean that the work in providing some students with a basic level of ICT skills and digital competence most likely did not take place. Many of these students most likely had other ICT skills that they had acquired outside of school, which may have been of interest to make use of in the classroom (Lai, Khaddaget & Knezek, 2013). Students with skills in social media and digital media could have utilized these skills in the classroom for schoolwork and could have been used as a force in the classroom for schoolwork. In addition, the somewhat low use of the laptops in the classroom and the possibility to choose to use the laptop or pen and paper are also related to the uptake and use of digital technologies in the classroom and ICT skills. For the student who chooses pen and paper for doing schoolwork most of the time, it is possible that the student may not have the basic ICT skills needed. These students may, for example, not want to show that they do not have the skills necessary or may be afraid that they do not have the skills needed to complete a classroom task. These students may need an introduction to ICT

skills related to using the laptop as an educational tool as well as practice in using the laptop as an educational tool. The lack of supporting and developing ICT skills for students can be said to manifest a filter in regard to the uptake and use of digital technologies and the conditions for TEL and educational change in the classroom.

From the student perspective, in both schools, the relatively low laptop use is understood to manifest a filter in the resource element Tools and People. As noted above, the use of the laptops made students feel more responsible for their schoolwork and made schoolwork more fun. They reported creating their own safe learning environments and using the laptops to take short breaks during long days of lessons (A1). These short breaks were sometimes necessary due to tasks that were not designed for work with the laptop or sometimes long periods of work with the laptops with tasks in which the laptops were needed (A1; A3). At the same time, many students saw the laptop as a distraction. Non-school activities such as social media, browsing the Internet and games were evident in the classroom observations (A1; A2; A3) as well as students who did not have their laptops with them in class. The reasons for this were many: no battery, too heavy to carry and teachers seldom use them in lessons (A1; A3). Here, students will need teachers' help in focusing on school tasks and using the laptop as an educational tool. If the laptops are not used in the classroom, the possibilities for TEL are apparently lost. Therefore, increasing the uptake and use of digital technologies can be said to manifest a filter in this resource element for students as well as limiting the technical problems that appear to have continued from Phase 1 to Phase 3.

### **The teacher perspective**

From the teacher perspective, it seems that teachers at both schools continue to be optimistic over time, with an increased focus on use as well as noting a development in activities, from technology to pedagogy, from Phase 1 to Phase 2 and further to Phase 3. Challenges continue to prevail in the form of the time and need for TPD, technological problems and the need for pedagogical leadership for ICT. In summary, the uptake and use of digital technologies in the classroom from Phase 1 to Phase 2 and further to Phase 3 can be illustrated as in Table 4 below.

Table 4. From Phase 1 to Phase 3 in summary - development in teachers' activities.

Themes	Phase 1	Phase 2	Phase 3
Preparedness	Low, undecided level of preparation	Insufficient preparation	Continued optimistic view toward ICT
	Optimistic or very optimistic view toward ICT	Continued optimistic view toward ICT	
Use	Low laptop use initially	Increased laptop use in school	Laptop use and technological problems
	Increased use expected	Shift from use toward reflective use	
	Technological awareness	Pedagogical awareness	
Own teaching and learning	Opportunities for TPD expected	Time needed for TPD and teacher collaboration	ICT skills, access to planned TPD, time for collaboration
	Classroom management issues expected	Classroom management issues for maintaining student focus	Focus on student use and students' non-school activities
	New forms of teaching expected	Element of choice for students and teachers	Element of choice for students and teachers

When using the Ecology of Resources Model the development of teachers' activities over time can be illustrated as in Figure 4 below.

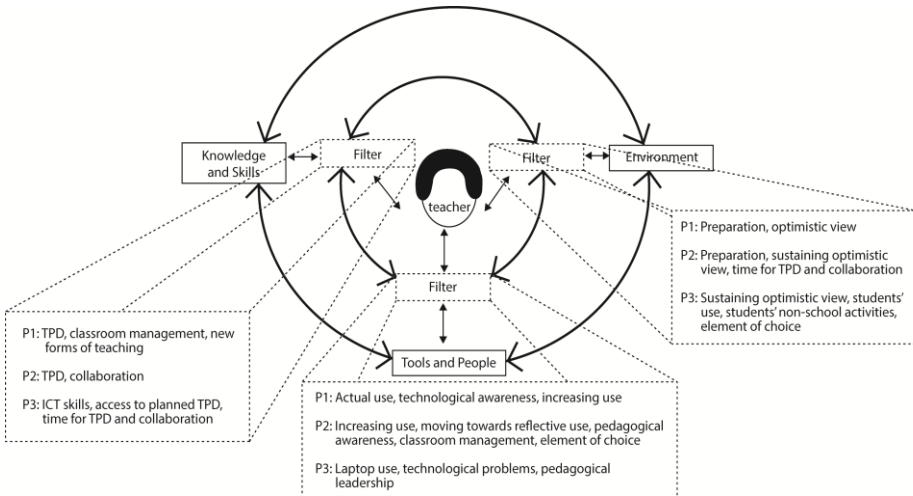


Figure 4. From Phase 1 to Phase 3, the teacher perspective in summary. The Ecology of Resources Model (Luckin, 2010). Elements and their filters.

In the resource element Environment, the need for teachers to support collaborative use for students in the classroom manifests a filter. How teachers support the conditions for TEL and collaboration in the classroom will most likely have an effect on student use. In order to support students' use, teachers will need to develop their own use. That teachers provide classroom tasks and activities that are designed for and aligned to TEL will also be important for students' learning in the classroom (cf. Hauge, 2014; Olofsson et al., 2011; Perotta & Evans, 2013). Teachers will need TPD that intertwines pedagogy, technology and content and that provides a deeper and more reflective understanding of how to design tasks for the TEL classroom (Ertmer & Ottenbreit-Leftwich, 2010; Mishra & Koehler, 2006; Voogt et al., 2013b) in order to create the conditions for TEL through collaborative work. It is most likely that teachers will need to design and experiment with task design in the classroom. This will perhaps be a challenge as task design requires a move from traditional tasks toward new task designs for the digitalized classroom. One major factor here is time. The teachers need time outside their ordinary teaching obligations. They need organized and systematic time to, together with their colleagues, discuss the work in the 1:1 classroom (A2; A3). Another factor that will be of importance is how teachers collaborate within their specific subject areas and across subject areas for developing their own use and supporting students' use of digital technologies (Drayton et al., 2010; Ertmer & Ottenbreit-Leftwich, 2013). This type of subject-related work which involves systematic ways of supporting and contributing to collaborative teaching and learning environments for sharing and developing materials with other teachers, appears to be in process in both schools as well as having developed from Phase 1 to Phase 2 and further to Phase 3 (A2; A3). It should also be noted that teacher collaboration is recognized as important by the school leaders in both schools (A4).

In regard to the resource element Knowledge and Skills, the importance of teachers receiving TPD in ICT and subject-related skills is widely reported in the international literature (Hixon & Buckmeyer, 2009; Tondeur et al., 2010; Vrasidas, 2014). The voices of the teachers in this thesis reflect such a conclusion when expressing that in order to increase the uptake and use of digital technologies and to create possibilities for TEL in the classroom in a more informed way, they also need accurate tools for doing so (cf. Bocconi et al., 2013). One critical incentive expressed by the teachers for such TPD activities to take place is time, as noted above, which manifests a filter in this resource category. As this seems to have been the case over the years in the schools studied, the aspect of time is a significant challenge. The school organizations, or maybe in particular the school leaders, need to create further possibilities for the teachers to attend TPD activities that take place

during their working hours and contain activities that address questions concerning teaching and learning activities in the 1:1 classroom. This entails creating time for teachers to engage in TPD on their own as well as organized and systematic time. Given the rather hectic working life in both schools, and Swedish schools in general (cf. National Agency for Education, 2013b), this will with no doubt be a difficult task to accomplish. At the same time, however, to participate in TPD outside working hours or in TPD activities that are not specifically directed toward the uptake and use of digital technologies will probably do little, if anything at all, to improve the 1:1 classrooms.

It is possible that increased ICT skills for the teachers will facilitate the move from technology to pedagogy (Ertmer et al., 2012) and support students' use of digital technologies in their learning. In addition, teachers' work with task design will most likely also help students to direct their focus even more toward schoolwork (Voogt et al., 2013a). In line with Vrasidas (2014), it seems to be important that the TPD also takes regard of the individual teacher's needs and that there is a systematic plan for TPD in the schools (cf. Tallvid, 2010; 2015). This can, for example, provide teachers access to collaborative work methods to share both within their subject areas and across subject areas (Towndrow & Wan, 2012). While many of the teachers in this thesis, who had achieved the level of PIM, which was recommended by the National Agency for Education (Level 3), could attend seminars for using interactive whiteboards and had the possibility to receive supervision by an educational technologist prior to and during the 1:1 initiative, there did not appear to be any systematic plan for TPD (A2; A3). This may be the result of prioritization but is most likely also the result of the many areas of development in both schools and the time necessary to meet these many areas (A4).

Even if the role of the teacher in the classroom is very important (Hattie, 2009; Kirkwood & Price, 2013), teachers in some cases also will likely have to both accept that students are more proficient in certain ICT skills (cf. Blikstad-Balas & Hristendahl, 2013) and to utilize the informal skills that the students bring with them (cf. Lai et al., 2013). The lack of this acknowledgment among the teachers can also be interpreted as a filter in the resource element Knowledge and Skills. Some results in this thesis point toward the fact that such acceptance has increased over time at both schools, such as teachers collaborating with students and helping each other out in the classroom (A2; A3). However, taken together, the lack of continuous support for teachers to develop their ICT skills can be said to manifest a filter.

Increasing teachers' own uptake and use of digital technologies and providing opportunities to increase students' uptake and use of digital technologies in school activities in the classroom are perhaps the most important challenges. These challenges can be said to manifest filters in the resource element Tools and People. Increased ICT skills for teachers and TPD will most likely increase the uptake and use in the classroom (Sipilä, 2014). Teachers may need help in seeing the potential benefits of digital technologies, sharing and collaborating within and across subject areas and time-efficient work methods (Ertmer & Ottenbreit-Leftwich, 2013; Towndrow & Wan, 2012). In this thesis, laptop use could be considered to be somewhat low, for instance, using digital technologies in the classroom once a week (A2; A3). However, teachers are balancing teaching and learning activities that, on the one hand involve the use of digital technologies and TEL, and, on the other hand, can be said to mirror so-called traditional school methods. In other words, these activities involve the aspect of pedagogical decisions. These pedagogical decisions are important, as they will involve the decision by the teacher about when, why and for what tasks the student should, or even must, use the laptop. In the results, it can be seen that one strategy used by the teachers in order to increase the use of the laptop is to design tasks that the students cannot complete without using their laptop. Put differently, these activities involve the teachers moving beyond the individual choice of the student (A3). These kinds of tasks, if designed in a thought-through way, will probably provide students with the possibility to fulfill the curriculum requirements of developing 21<sup>st</sup>-century skills and digital competence. Holding in mind that removing students' individual choice can decrease student motivation such tasks can also be rewarding for students who either do not often use digital technologies outside of school or who have restricted access to such technologies (cf. Warschauer et al., 2014). In addition, the design of this type of task can support the development of new work methods, the adoption of TEL and maybe in the end also function as an important aspect when it comes to educational change in the schools.

### **The school leader perspective**

From the school leader perspective, it appears as if the school leaders at both schools maintained an optimistic view of the 1:1 initiative from Phase 1, to Phase 2 and further to Phase 3. They report seeing possibilities in collaboration for students and teachers, follow-up and creating an overview of the organization. The uptake and use of digital technologies is spoken about as a natural part of the daily work. Challenges appear to lie in the many competing areas of development and increasing use and time for supporting and promoting the uptake and use of digital technologies. In

summary, the uptake and use of digital technologies in the classroom over time can be illustrated as in Table 5 below.

Table 5. From Phase 1 to Phase 3 in summary - development in school leaders' activities.

<b>Themes</b>	<b>Phase 1</b>	<b>Phase 2</b>	<b>Phase 3</b>	
Preparedness	Optimistic view of the 1:1 initiative	Maintaining an optimistic view of the 1:1 initiative	Competing areas of development	
	Overcoming resistance to digital learning	Lack of preparation		
	Own skills and impact on goals	Own skills	Own skills	
Use	Technology access	Lack of standardized systems	Increasing use	
	Support for teachers and students	Support for students		
	Using new tools to exchange knowledge and to provide new forms of teaching and learning	New possibilities for distance learning		
	Tools as a natural part of daily work		Uptake and use as a natural part of learning	
Supporting teaching and learning	Supporting teachers to see the benefits	Creating common goals, collaboration and sharing	Supporting a collaborative environment	
	Increasing skills and accessing new knowledge for teachers and students	Skills for teachers and students	Teachers teach teachers	
	Increased dialog and creating a more active learning environment	Responsibility		Time for increasing subject-specific knowledge
		Overcoming the traditional environment		Sharing and documenting materials
		Leaders taking the lead		Creating an organizational overview

When using the Ecology of Resources Model, the development of school leaders' activities over time can be illustrated as in Figure 5 below.

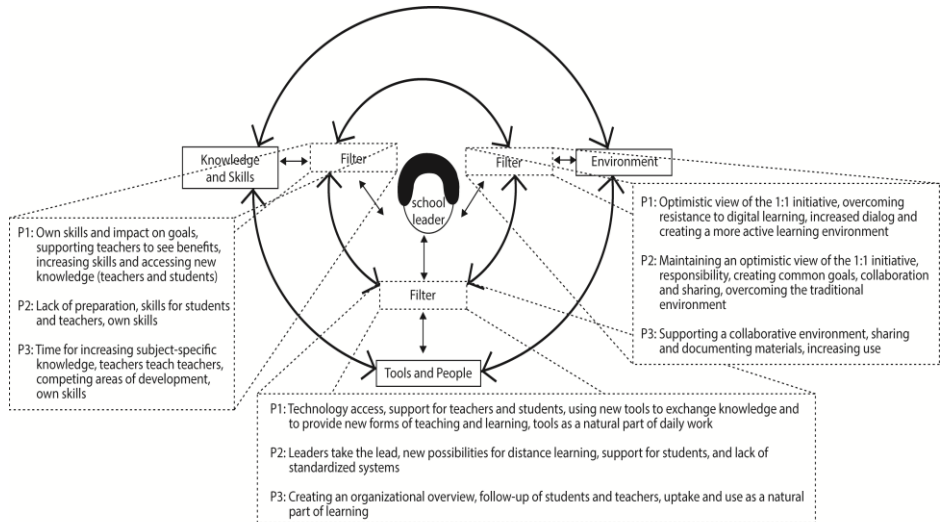


Figure 5. From Phase 1 to Phase 3, the school leader perspective in summary. The Ecology of Resources Model (Luckin, 2010). Elements and their filters.

In the resource element Environment, the role of the school leaders in supporting teachers in developing a collaborative environment with other teachers and their students will be an important step in supporting the development of digitalized modern learning environments (cf. Dexter, 2008; Williams, 2008). How this work proceeds can be described as manifesting a filter in this resource element. Following the results from both this thesis and international research (Dexter, 2008; Toy, 2010; Williams, 2008), school leaders will most likely need to develop their own skills and use of technologies in order to support students' and teachers' use of digital technologies. School leaders from different schools create collaborative environments to share experiences and activities in the 1:1 school. The school leaders in this thesis report supporting collaboration both for students and teachers as being important in the everyday work in both schools (A4).

School leaders need time for and access to professional development for leadership skills for promoting and prioritizing the uptake and use of digital technologies and for supporting teachers' and students' work in digital technologies (Dexter, 2008; Williams, 2008). Therefore, the lack of these skills can be said to manifest a filter in the resource element Knowledge and Skills. The school leaders who participated in this research project acknowledged the need to lead for the uptake and use of digital technologies. However, this work was mostly integrated into other educational issues such as grading and assessment (A4). Building on the results of this thesis, the need to develop ICT skills among the school leaders can also be considered to be a filter. It may be that the lack of ICT skills among school leaders makes

it easier for them to understand the challenges that teachers and students face (Koh, 2015). However, these ICT skills will be necessary in order to lead for 1:1 and to achieve systematic methods to document collaborative knowledge and skills within the schools as well as for dissemination of this knowledge and these skills. At both schools, the school leaders report work that comprises sharing and collaboration for teachers (A4). Another aspect of importance for school leaders will be the work with structural and cultural challenges within the schools for promoting, supporting and facilitating the work with 1:1, TEL and educational change.

In the resource element Tools and People, for school leaders, it will be important to create stable and sustainable technical environments to support and enable teachers' and students' work in the 1:1 classroom (cf. Dexter, 2008; McGarr & Kearney, 2006; Vanderlinde & van Braak, 2010). This will also entail involving educational technologists for support in technical and pedagogical issues, and therefore supporting the tools and the people, that is facilitating teachers as they move from a technology focus to a focus on pedagogy when working in the 1:1 classroom. For the school leaders in this research project, their leadership for 1:1 through supporting teachers' collaborative work and sharing of materials (A4) will be important in this move. Therefore, actual use, technological challenges and pedagogical support can all be said to manifest a filter regarding increasing the uptake and use of digital technologies in this 1:1 initiative.

### **Some differences between the classes and the schools**

In using the Ecology of Resources Model as a collective prototype for the filters in the different resource elements, it is important to be aware of possible differences between the classes and the schools. The differences in the resource elements Environment, Knowledge and Skills, and Tools and People are discussed from the student, teacher and school leader perspectives.

#### ***Differences within the resource element Environment***

For the students in the classes in the compulsory and the upper secondary schools, there were no major differences in the results. Students in both schools used their laptops in lessons for schoolwork and non-schoolwork activities and created their own learning environments through the laptop. Although laptop use varied in all classes, the work, according to the results, was mainly individual work (A1; A2). According to the analysis of the data, there did not seem to be any major differences regarding school level or if the program was a theoretical or vocational program.

For the teachers at both schools collaborative work developed from Phase 1 to Phase 2 and further to Phase 3, and teachers at both schools expressed the need for TPD through collaborative activities with other teachers (A2; A3). Further, in this thesis, the uptake and use of digital technologies in the classroom in both schools showed wide variation, from fully digitalized classrooms to classrooms in which the laptops were not used (A1; A2; A3). This reflects the different levels of teachers' uptake and use and the conditions for TEL and educational change in the classroom. There were examples of classrooms where no use had developed to limited use (A2; A3). The school leaders noted that some teachers' use had developed over the phases (A4). However, this dimension was specifically related to individual teachers and the individual teacher's level of ICT skills. Therefore, in some classrooms, increasing laptop use would entail more work with supporting teachers' ICT skills than in other classrooms. However, the level of work needed in order to support collaborative learning in the classroom is perhaps not of interest, other than identifying that the need for supporting this work prevails.

For school leaders, there are most likely differences between schools in leading for the uptake and use of digital technologies for supporting collaborative learning due to the size of the schools. However, the school leaders at both schools appear to acknowledge and support teacher collaboration as well as noting collaboration with other school leaders as something that has developed over time (A4). This may mean that collaborative learning to promote TEL and the conditions for educational change has been initiated.

In summary, the conditions for TEL and educational change do not appear to differ between the classes and schools in regard to the resource element Environment from Phase 1 to Phase 2 and further to Phase 3. Therefore, the lack of supporting collaboration from the student, teacher and school leader perspectives and the lack of systematic sharing of materials and subject-related collaboration for teachers and school leaders at both schools can be said to be filters in this resource element. In other words, supporting and creating possibilities for collaborative learning from the student, teacher and school leader perspectives will most likely have a strong impact on the uptake and use of digital technologies in this 1:1 initiative.

### ***Differences within the resource element Knowledge and Skills***

In the resource element Knowledge and Skills, filters can be interpreted in ICT skills within the student, teacher and school leader perspectives. In using the Ecology of Resources Model as a collective prototype for the filters in the resource element environment, there are both similarities and

differences between the classes and the schools. From the school leader perspective, all of the school leaders appear to support the uptake and use of digital technologies and ICT skills for both students and teachers (A4). This is, however, not done explicitly but implicitly, as school leaders see the uptake and use of digital technologies as integrated in teaching and learning. For example, the uptake and use of digital technologies is combined with assessment, grading and evaluation work (A4). However, specific ICT skills, both basic and more advanced, are perhaps necessary in order to create the conditions for students to achieve 21<sup>st</sup>-century skills and digital competence and for teachers to be able to support this work. Further, to have the ICT skills needed for leading for 1:1, school leaders will most likely need to increase their own ICT skills in order to prioritize and lead this process in a sustainable way (Hauge et al., 2014; Hayes, 2006). Although the schools differ in size, the need to prioritize for 1:1 and promote collaborative work for teachers and students to increase teaching and learning and ICT skills appears to be similar.

Even if ICT skills and TPD are needed according to the majority of the teachers in this thesis (A2; A3), there is little difference seen between the two schools. As noted in the research literature, the uptake and use of digital technologies is related to context and subject (cf. Fleischer, 2012; Penuel, 2006). Therefore, this difference is perhaps more evident between the teachers in each school than between the two schools. If accepting that teachers who see the benefits are confident in the use of ICT, and feel support from school leaders, these teachers will perhaps tend to use ICT more in the classroom (cf. Sipilä, 2014; Yeung et al., 2012;). Providing TPD for teachers in ICT skills will have an impact on teachers' uptake and use of digital technologies in the classroom by increasing their confidence and their awareness of the benefits. Thus, from a teacher perspective, supporting and developing ICT skills can be said to be a filter.

Supporting and developing ICT skills can also be said to manifest a filter from the perspective of the students. For the students in this 1:1 initiative, there was no basic course in ICT skills. However, it is possible that there were large differences in skills between students. Most students appeared, according to self-reported data, to have the basic ICT skills needed, but lacked more advanced skills (A1). It should be noted that according to the results, the students over time felt that their ICT skills increased (A3). On the other hand, and interestingly enough, teachers reported that students lacked the necessary ICT skills (A2; A3). This may be the result of students and teachers having different ideas about what ICT skills are as well as what ICT skills are needed for schoolwork (cf. Voogt et al., 2013a). Further what could be interpreted as low level of use of the laptops in the classroom appeared to

be similar between the classes (A3), which would imply both the difficulties to increase ICT skills in school and that the students probably used their laptops outside of school to increase their ICT skills. These differences were seen to be about the same in the schools, regardless of the school level. However, one important difference was seen on the class level. This difference was related to the uptake and use of digital technologies in the classroom in the vocational program in the upper secondary school. For the students in this program, the uptake and use of digital technologies was not only related to schoolwork in school subjects, but also related to the vocation which the students were being prepared for. This meant that the students in this class needed ICT skills for traditional subjects that were included within their program but also recognized the more work-oriented use at their coming place of work. Therefore, developing ICT skills for these students, included a somewhat broader range of ICT skills. These skills were expected to be attained by the students during their schooling in the vocational program. In comparison, in the theoretical program, similar skills would perhaps be acquired at a workplace in the future, or, for the compulsory school classes, to some extent in their schooling at upper secondary school. However, although differences were seen in supporting and developing ICT skills between the different programs, the need to support and develop these skills prevailed, although perhaps to a greater extent in the vocational program.

In summary, the lack of possibilities to develop and support ICT skills from the student, teacher and school leader perspectives could be said to manifest a filter in the resource element Knowledge and Skills for the uptake and use of digital technologies, the conditions for TEL and educational change in the 1:1 classroom.

### ***Differences within the resource element Tools and People***

Supporting and developing the uptake and use of digital technologies, as well as students', teachers' and school leaders' roles in supporting and developing the uptake and use of digital technologies in the classroom, can be said to manifest a filter in the resource element Tools and People.

In this thesis, the somewhat low uptake and use of digital technologies from the student perspective, that is to say, student laptop use appeared to be similar between the schools. Students in the upper secondary school classes and the compulsory school classes had their laptop either with them or not with them to a similar extent. However, having the laptop with them in lessons appeared to often be planned ahead of time with the teacher. The same applied for subjects. Students foresaw if the teacher would introduce tasks that required the use of the laptop (A1; A2). This appeared to be related

to the teacher and the subject and meant that in one lesson all of the students had their laptops with them, but not in the next lesson. Cases in which the students had forgotten their laptops or in which the laptops were not charged or had been handed in for repair also appeared to be about the same in the different classes and schools.

From the teacher perspective, the somewhat low uptake and use of digital technologies in the classroom in regard to their own use was relatively the same. As noted before, the uptake and use by teachers showed a wide variation, which most likely was related to both the subject and the teachers' own beliefs about the uptake and use of digital technologies in the classroom (cf. Ertmer et al., 2012; Inan, & Lowther, 2010; Tay et al., 2012). The same wide variation was noted in the upper secondary school, in the theoretical program as well as the vocational program and also in the two compulsory school classes. Teachers' use of digital technologies appeared to be a pedagogical choice, but there was also double planning (A2;A3), which was necessary in the case that students did not have their laptop with them and needed to be able to complete a task with paper and pencils. In regard to the uptake and use of digital technologies and student use, there were differences between the two schools in relation to two issues: responsibility and choice. In the upper secondary school, many teachers regarded students' use of the laptop as the responsibility of the student. For example, if a student used the laptop to play games during the lesson, it was the student's responsibility. In the compulsory school classroom, maybe because the students were younger, teachers intervened and told students who were engaged in non-school activities to close the laptop. Here, teachers took on the responsibility of the students' use to a greater extent. Another difference that was seen between the schools was the possibility of choice. The choice of using the laptop was given to a greater extent and more explicitly by teachers to the younger students. For example, if students were to take notes, they could choose to do this on the laptop or with paper and pencils. This may have been due to the teachers' desires to include all of the students in the work, knowing that many students had forgotten their laptops or that they were being repaired. In the upper secondary school, choice was often not stated explicitly. It was up to the student to decide whether or not to use the laptop. In many of the classes, students were told to close their laptops, either to signal the start of a lesson, to gain students' attention or to create focus on a complex or difficult task (A2; A3). That different teachers used the laptops differently appeared not to be a problem for the students (A1; A3).

From the school leader perspective, the work at the schools for supporting and developing the uptake and use of digital technologies was similar in that both schools had begun processes for teachers to share and collaborate

regarding materials as well as presenting best-case examples of work (A4). Similarly, this work did not involve developing and increasing the uptake and use of digital technologies explicitly through prioritization of leadership for 1:1. The work instead was done implicitly through other areas of educational importance in which digital technologies were integrated, such as work with assessment, course plans and follow-up of students (A4). In summary, the lack of support and development of the uptake and use of digital technologies can be said to be a filter in the resource element Tools and People. Put differently, increasing the uptake and use of digital technologies in the classroom from the student, teacher and school leader perspectives will most likely have a strong impact on creating the conditions for gaining and sustaining TEL in this 1:1 initiative and future educational change at the schools.

### **Discussion in summary**

In regard to the uptake and use of digital technologies in the 1:1 classroom in the two schools, the results of the case study consisting of four empirical studies in this thesis can be summarized as supporting collaborative learning (resource element Environment), supporting and developing ICT skills (resource element Knowledge and Skills) and increasing the uptake and use of digital technologies (resource element Tools and People).

The results of this thesis point toward the importance of supporting a pedagogical and technical environment for collaborative learning and TEL at the schools. Therefore, the lack of supporting collaborative learning in the two schools can be said to manifest a filter in the resource element Environment from the student, teacher and school leader perspectives in this 1:1 initiative. The importance of supporting and developing ICT skills for students, teachers and school leaders is also seen in the results of this thesis. In consequence, not supporting and developing ICT skills is interpreted as manifesting a filter in the resource element Knowledge and Skills. To continuously support 21<sup>st</sup>-century skills will be of importance in the future for this 1:1 initiative, as will providing basic and more advanced ICT skills for students, teachers and school leaders (cf. Vrasidas, 2014; Warschauer et al., 2014; Williams, 2008). Probably one of the most important challenges for students, teachers and school leaders is found in the resource element Tools and People. This challenge will be increasing the uptake and use of digital technologies as tools for school activities in this 1:1 initiative. All of the aspirations for student motivation and outcomes (cf. Bebell & O'Dwyer, 2010; Lei & Zhao, 2008; Penuel, 2006; Rockman, 2007), TPD for teachers (Holcomb, 2009; Kopcha, 2012; Søby, 2013; Vrasidas, 2014), professional development for school leaders and educational change (cf. Cuban, 2013;

Fullan, 2011; Olofsson et al. 2011) are connected to the uptake and use of digital technologies, that is actual laptop use.

In summary, using the Ecology of Resources Model (Luckin, 2010), these perspectives illustrate the interdependencies and the synergies of the resources involved from the different perspectives included in a case study of 1:1. There are common issues involved. For students, teachers and school leaders, these common issues comprise both technical challenges and pedagogical challenges. In order to create conditions for TEL, it is important that the technology works, in order for the pedagogical issues to be in the forefront. In this thesis, teachers and school leaders report the development from technology to pedagogy and acknowledge the possibility of creating conditions for TEL and educational change. Therefore, access and, most of all, actual use will be important for supporting the continued uptake and use of digital technologies in the 1:1 classroom work. Furthermore, if school leaders support teachers' use, teachers will perhaps be more able to support students' use. Teachers' use of the laptops in teaching in lessons and students needing to have their laptops with them in lessons to use them in the classroom work appear to be crucial challenges in this ecology of resources. These challenges regarding uptake and use could be considered to be somewhat remarkable in a case study of a 1:1 initiative. Therefore, it is most likely that the interdependencies between the student, teacher and school leader perspectives will have an impact in creating the conditions for TEL in the classroom and in the long term educational change in both schools.

# Conclusion

The aim of this thesis was to explore, identify and describe the possibilities and challenges related to the uptake and use of digital technologies and through this gain knowledge regarding the conditions for TEL and educational change in a 1:1 initiative in two schools over two years. The use of the Ecology of Resources Model (Luckin, 2010), and the concept of filters as a framework to capture and illustrate the uptake and use of digital technologies as teaching and learning activities developed over time in the 1:1 classroom and contributed to the identification of these possibilities and challenges as a result. The exploratory use of the Ecology of Resources Model (Luckin, 2007) also contributed to a wider and deeper understanding of the uptake and use of digital technologies in the classroom by identifying possibilities and challenges related to the conditions for TEL and educational change.

The results from the case study point toward technological and pedagogical challenges as well as the time and need for ICT skills for students, TPD for teachers and continued professional development for school leaders. The reported possibilities are related to creating the conditions for TEL and educational change through the leadership for ICT and the activities in the 1:1 classroom. These activities, for example, involve thought-through uptake and use of the laptops in classroom activities in which teachers' didactical design of student tasks includes the use of the laptop as a tool for learning. The results reveal interdependencies and dependencies, isolated and collaborative work as well as volatility and sustainability in providing conditions for TEL and educational change. All of these possibilities and challenges, seen as an ecology of resources, have practical implications.

The uptake and use of digital technologies in a 1:1 initiative involved the hopes for students to enhance their learning and gain 21<sup>st</sup>-century skills and as a catalyst for TPD for teachers on a daily basis working in the digitalized classroom. As reported in this thesis, a somewhat low level of use can be considered to be a risk. That low use seems to correspond with a risk of digital technologies in the schools being underused (Cuban, 2001) and might not be a surprise but, and more importantly, what can be done to turn this around must be problematized. This will be important to push activities as a part of the processes of educational change in K-12 schools that can in turn create stable conditions for TEL. According to this study, such activities may for example be a necessity in order to provide students with a more formal introductory course related to ICT skills and the laptop as an education tool in their schoolwork. This would also make it possible to bridge the informal

knowledge, which students bring with them and may have use for in the classroom. For teachers, the need for time for TPD activities as well as the need for systematic TPD, both individualized TPD and joint TPD, appears to be important to gain and sustain TEL in the classroom as teachers weigh and balance use in the classroom activities. For the school leaders who are responsible for students' outcomes and teachers' TPD, activities that target their own professional development, and skills in prioritizing and leading for 1:1, will also be key issues. The role of the school leader will be important in changing the school culture and helping teachers make the move from technology to pedagogy. Another related issue here is financial support from municipalities for TPD as well as technical support. These financial challenges are reflected as a recent decision by the municipality of Umeå, in regard to not providing sixth-graders with laptops (P4 Västernorrland, 2014).

Another interesting result of this thesis is that, in some aspects, there is a rather wide variation in the uptake and use of digital technologies in the classroom. This was seen between the schools and could, according to the analysis be related to work methods, programs and subjects. However, these wide variations were actually also seen between the classrooms in the same schools. These variations, ranging from a continuum of no use in classroom activities to fully digitalized use in classroom activities, most likely have an impact on the conditions for TEL as well as digital equality for students. One question to ask here is if the uptake and use of digital technologies in the classroom is to be dependent on the ICT interest and engagement of the teacher. Another is if this will be a risk that leads to students perhaps not developing the digital competence and 21<sup>st</sup> century skills needed in continued schooling and working life. A third question is if the teachers and students should be given the option of using or not using digital tools such as laptops in their teaching and learning practices. Questions such as these may be challenging for the school system, but may nevertheless be of great significance to put forth. In light of the results, this thesis indicated that the large variation of use seems to make it even more difficult to create conditions for TEL and educational change in the schools.

It may be that some schoolwork will, or even should not involve the laptop, such as learning to knit in sewing class, sketching by hand in art class or dissecting a rat in biology class. However, in other kinds of schoolwork, where the laptop has the potential to facilitate learning, it will be important that the student task is designed in such a way that it combines and promotes both subject-related knowledge and skills, such as problem solving, reflection and critical thinking.

In the short term, the practical implications of the uptake and use of digital technologies, specifically in 1:1 initiatives, seem to be strongly connected to sustainability in schools. In the long term, if sustainable conditions for TEL and educational change in the 1:1 classroom can be created and upheld, the practical implications may be teachers' improved skills to integrate a thought-through teaching practice concerning the use of laptops as well as an increase in equalities in digital competence between students, between schools, as well as between classrooms in the same school. Furthermore, sustainability in a school most likely also reflects that the school leaders have improved in their leadership for ICT.

At last, it should be noted that in Sweden, compared to other countries in Scandinavia and internationally, the uptake and use of digital technologies in the classroom, 21<sup>st</sup>-century skills and gaining and sustaining the conditions for TEL in the classroom are not expressed explicitly in the curriculum. It can be argued that clearer recommendations through policy could accelerate the uptake and use of digital technologies. However, this is uncertain (cf. Sjøby, 2013) as there appears to be a continued considerable gap between policy and practice. It is possible that stronger efforts in practice, such as implementing introductory ICT courses for students, increased TPD and time for TPD for teachers, may have more explicit effects. Further, as touched upon above, increased skills for school leaders in prioritizing and leading for 1:1, documenting and disseminating best practice and supporting students' and teachers' use would most likely have tangible effects as well. It is also possible that these efforts could accelerate the uptake and use of digital technologies in the classroom, therefore supporting teachers' and students' work and providing stronger conditions for TEL and educational change.



# Future Research

In the future, several issues of importance for continued research can be identified. As a doctoral thesis in itself is restricted by a limited time frame, it will be of importance to combine and analyze the data collected during the last year of this 1:1 initiative. This data will comprise Phase 4 of this research project and will hopefully give further insight into how the work with the uptake and use of digital technologies in the classrooms has continued and developed over time.

For students, future questions of research entail how the actual use of the laptops can be supported in the classroom. How can, for example, students' ICT skills gained in an informal context outside of school be transferred to the classroom and what are the possibilities and challenges in transferring these skills? Another interesting question to study from the student perspective is continued research into the differences in students' experiences regarding the alignment between their skills and teachers' ICT skills.

From the teacher perspective, how teachers design their teaching activities for the uptake and use of digital technologies in the digitalized classroom will of importance to investigate in future research. Questions regarding TPD will be of interest to follow, both on an individual and joint level, as well how teachers develop systematic strategies to share and collaborate. These issues will be of importance to study from both the perspective of in-service teachers and new teachers entering the field. In addition, how teachers, through the uptake and use of digital technologies in the classroom work, toward the move from technology to pedagogy will continue to be an important question for future research.

School leaders' leadership for ICT in general, and 1:1 in specific, including supporting teacher' and students' work with the uptake and use of digital technologies and creating conditions for TEL and educational change, will be important to address in the future. How school leaders engage in collaborative efforts to share experiences, build networks and further their own professional development will also be of interest to explore.

A final suggestion for future research is the continued use and development of the Ecology of Resources Model (Luckin, 2010) to capture, explore and describe the continued work toward creating conditions for TEL and educational change in K-12 schools. This could, for example, involve the use of the Ecology of Resources Model to explore other empirical perspectives,

such as the parent perspective. What possibilities and challenges parents see in relation to the uptake and use of digital technologies and the implications for their children would be of interest to study. Using the model to explore the student perspective more in depth, for example from the perspective of students with special needs or a student perspective with a focus on gender would also be interesting to study. Another perspective of interest to study would be pre-service teachers. This could involve the study of ICT competence and skills as well as new teachers' preparation regarding the uptake and use of digital technologies in the classroom. Another idea would be to put the model to use in redesigning classroom teaching with the goal of creating conditions for TEL and educational change.

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# Appendix A: Information to teachers and school leaders (In Swedish)

Umeå Universitet  
Pedagogiska institutionen  
Marcia Lindqvist  
Anders D. Olofsson



## ***Informationsbrev till lärare och rektorer på XXXXXXXXX***

Hej!

Jag heter Marcia Lindqvist och är den doktorand som är knuten till forskningsprojektet Unos Umeå. Anders D. Olofsson är ansvarig för projektet. Det är nu dags att sätta i gång datainsamlingen genom den första övergripande enkätundersökningen.

Syftet med denna enkät är att skapa en bild av nuläget för projektet Unos Umeå. Enkäten tar någonstans mellan 15-20 minuter att fylla i. Enkäteten besvaras anonymt, du har rätt att när som helst välja att inte besvara enkäten och resultat ska bara användas för forskningsändamål.

Dina synpunkter är viktiga för undersökningen!

Stort tack på förhand!

[marcia.lindqvist@pedag.umu.se](mailto:marcia.lindqvist@pedag.umu.se)

090-786 7000, 070-259 3176

[anders.d.olofsson@pedag.umu.se](mailto:anders.d.olofsson@pedag.umu.se)

090-786 7809

# Appendix B: Information to students (In Swedish)

Umeå Universitet  
Pedagogiska institutionen  
Marcia Lindqvist  
Anders D. Olofsson



## Till elever på XXXXXXXX

Hej!

Jag som skriver detta brev heter Marcia Lindqvist. Jag är forskarstuderande och arbetar på Pedagogiska institutionen vid Umeå universitet.

Som en del av mitt avhandlingsprojekt kommer jag under en fyraårs period att följa elever, lärare och rektorer på XXXXXXXX med fokus på användningen av bärbara datorer i samband med Umeå kommuns en-till-en satsning. Projektet, Unos Umeå, är ett samarbete mellan Umeå kommun och Pedagogiska institutionen på Umeå universitet. Jag ska studera hur elever, lärare och rektorer använder digitala teknologier ur ett lärande, undervisnings- och socialisationsperspektiv. Detta innebär att ett antal datainsamlingar behöver komma att utföras på XXXXXXXX under projektets första tre år. Datainsamlingarna kommer att fokusera på elevers och lärares arbete med datorerna i klassrummet. Projektet har handlagts av Etikprövningsnämnden vid Umeå universitet.

Projektet är ett viktigt inslag för att undersöka arbetet med datorer i klassrummet och hur elevernas, lärarnas och rektorernas arbete förändras och utvecklas. Projektet ska möjliggöra en utveckling och förbättring av utbildning och undervisning samt vidare bidra till att utveckla inslaget av de digitala teknologier, vilka enligt tidigare forskning har en potential att kunna förhöja lärandet och utveckla det pedagogiska samarbetet.

Som en del i projektet planeras att under tre till fyra terminer, med start under mitten av HT2011, genomförs enkätundersökningar, intervjuer och

klassrumsobservationer. Deltagandet är helt frivilligt och datainsamlingen sker så att inga obehöriga får ta del av det insamlade materialet. Det är också alltid möjligt att kontakta ansvariga forskare och avbryta medverkan i projektet.

Vidare planeras inom ramen för projektet även ett antal intervjuer med frivilliga elever. Elever som medverkar i intervjustudien kan också alltid avbryta sin medverkan. Slutligen ska det också poängteras att data och resultat endast används i forskningssyfte.

Har ni frågor om projektet är ni välkomna att ringa till såväl mig som min handledare Anders.

Tack för att du tog dig tid att läsa denna information och lycka till med studierna med din bärbara dator!

Med vänliga hälsningar

Marcia

[marcia.lindqvist@pedag.umu.se](mailto:marcia.lindqvist@pedag.umu.se)

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# Appendix C: Information to students and parents (In Swedish)

Umeå Universitet  
Pedagogiska institutionen  
Marcia Lindqvist  
Anders D. Olofsson



Till elever och vårdnadshavare på XXXXXXXXX

Hej!

Jag som skriver detta brev heter Marcia Lindqvist. Jag är forskarstuderande och arbetar på Pedagogiska institutionen vid Umeå universitet.

Som en del av mitt avhandlingsprojekt kommer jag under en fyraårs period att följa elever, lärare och rektorer på XXXXXX med fokus på användningen av bärbara datorer i samband med Umeå kommuns en-till-en satsning. Projektet, Unos Umeå, är ett samarbete mellan Umeå kommun och Pedagogiska institutionen på Umeå universitet. Jag ska studera hur elever, lärare och rektorer använder digitala teknologier ur ett lärande, undervisnings- och socialisationsperspektiv. Detta innebär att ett antal datainsamlingar behöver komma att utföras på XXXXXX under projektets första tre år. Datainsamlingarna kommer att fokusera på studenters och lärares arbete med datorerna i klassrummet. Projektet har handlagts av Etikprövningsnämnden vid Umeå universitet.

Projektet är ett viktigt inslag för att undersöka arbetet med datorer i klassrummet och hur studenternas, lärarnas och rektorernas arbete förändras och utvecklas. Projektet ska möjliggöra en utveckling och förbättring av utbildning och undervisning samt vidare bidra till att utveckla inslaget av de digitala teknologier, vilka enligt tidigare forskning har en potential att kunna förhöja lärandet och utveckla det pedagogiska samarbetet.

Som en del i projektet planeras att under tre till fyra terminer, med start under mitten av HT2011, genomförs enkätundersökningar, intervjuer och klassrumsobservationer. Deltagandet är helt frivilligt och datainsamlingen sker så att inga obehöriga får ta del av det insamlade materialet. Det är också alltid möjligt att kontakta ansvariga forskare och avbryta medverkan i projektet.

Vidare planeras inom ramen för projektet även ett antal intervjuer med frivilliga elever. Elever som medverkar i intervjustudien kan också alltid avbryta sin medverkan. Slutligen ska det också poängteras att data och resultat endast används i forskningssyfte.

Har ni frågor om projektet är ni välkomna att ringa till såväl mig som min handledare Anders.

Tack för att du tog dig tid att läsa denna information och lycka till med studierna med din bärbara dator!

Med vänliga hälsningar

Marcia

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# Appendix D: Information and consent regarding group interviews (In Swedish)

Umeå Universitet  
Pedagogiska institutionen  
Marcia Lindqvist  
Anders D. Olofsson



## Information till elever och vårdnadshavare på XXXXXXX om gruppintervjuer

Hej!

Jag som skriver detta brev heter Marcia Lindqvist. Jag är forskarstuderande och arbetar på Pedagogiska institutionen vid Umeå universitet.

Som en del av mitt avhandlingsprojekt kommer jag under en fyraårs period att följa elever, lärare och rektorer på XXXXXXX med fokus på användningen av bärbara datorer i samband med Umeå kommuns en-till-en satsning. Projektet, Unos Umeå, är ett samarbete mellan Umeå kommun och Pedagogiska institutionen på Umeå universitet. Jag ska studera hur elever, lärare och rektorer använder digitala teknologier ur ett lärande, undervisnings- och socialisationsperspektiv. Detta innebär att ett antal datainsamlingar behöver komma att utföras på XXXXXXX under projektets första tre år. Datainsamlingarna kommer att fokusera på studenters och lärares arbete med datorerna i klassrummet. Projektet har handlagts av Etikprövningsnämnden vid Umeå universitet.

Projektet är ett viktigt inslag för att undersöka arbetet med datorer i klassrummet och hur studenternas, lärarnas och rektorernas arbete förändras och utvecklas. Projektet ska möjliggöra en utveckling och förbättring av utbildning och undervisning samt vidare bidra till att utveckla inslaget av de digitala teknologier, vilka enligt tidigare forskning har en

potential att kunna förhöja lärandet och utveckla det pedagogiska samarbetet.

Som en del i projektet planeras att under tre till fyra terminer, med start under mitten av HT2011, genomförs enkätundersökningar, intervjuer och klassrumsobservationer. Deltagandet är helt frivilligt och datainsamlingen sker så att inga obehöriga får ta del av det insamlade materialet. Det är också alltid möjligt att kontakta ansvariga forskare och avbryta medverkan i projektet.

Nu under våren kommer ett antal gruppintervjuer att göras med frivilliga elever för att undersöka hur eleverna uppfattar arbetet med datorerna i klassrummet. Tanken är att eleverna ska intervjuas i grupper om 3-4 elever och kommer att ta ca 30 – 45 minuter. Elever som medverkar i intervjustudien kan också alltid avbryta sin medverkan och all data och resultat endast används i forskningssyfte. Om ditt barn vill medverka i en intervju tillsammans med några klasskamrater är jag tacksam om ni skriver på och lämnar detta brev till klassläraren.

Har ni frågor om projektet är ni välkomna att ringa till såväl mig som min handledare Anders.

Tack för att du tog dig tid att läsa denna information!

Med vänliga hälsningar

Marcia

marcia.lindqvist@pedag.umu.se

anders.d.olofsson@pedag.umu

090-786 7000, 070-259 3176

090-786 7809

-----  
Jag godkänner att

(elevens namn) \_\_\_\_\_ deltar i en  
gruppintervju och att jag tagit del av denna information.

-----  
Ort och datum

Vårdnadshavares underskrift

[  ] Jag är intresserad av att medverka i en intervju om ett-till-ett projektet  
ur ett föräldraperspektiv.

-----  
Namn

-----  
Telefonnummer

## Appendix E: Survey - students

	<b>Survey-students</b>	UNOS UMEÅ - Initial survey - Fall 2011	
	<b>Background questions</b>		
1	Sex	<input type="checkbox"/> Male <input type="checkbox"/> Female	
2	Date of birth		
3	Program/class		
4	I have a computer at home	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	I have broadband at home	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6	I have my own mobile or iPad	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<b>Computer use</b>		
7	The 1:1 - project implies that all students receive their own computer. What do you think about this?	<input type="checkbox"/> Very good <input type="checkbox"/> Good <input type="checkbox"/> Not good or bad <input type="checkbox"/> Bad <input type="checkbox"/> Very bad <input type="checkbox"/> Don't know	
8	Compared with other people my age, I think that my computer skills are:	<input type="checkbox"/> Better <input type="checkbox"/> About the same <input type="checkbox"/> Not as good	
		1=Every day 2=Once a week 3=A few times a month 4=Seldom 5=Never	
9	I use my computer at home for schoolwork	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	

10	I use my computer during lessons	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
11	I use the computer at school to...		
	Search for information on the Internet	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Write	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Visit communities (for example, Facebook)	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Games	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Communication (e-mail, chat)	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Other uses? Please explain!		
		1=Every day 2=Once a week 3=A few times a month 4=Seldom 5=Never	
12	I use the computer at home to...		
	Search for information on the Internet	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Write	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Visit communities (for example, Facebook)	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Games	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Communication (e-mail, chat)	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Other uses? Please explain!		
13	With my computer, I can...	1=well 2=rather well 3=not very well 4=not at all	
	Send e-mails	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	
	Chat	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	
	Create presentations	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	
	Record sound	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	
	Edit a picture	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	
	Create a multimedia presentation with pictures, sound and film	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	
	Create and edit a home page	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	
	Visit communities	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	
	Other things? Please explain in your own		

	words!		
14	How are the computers usually used in the classroom?	<input type="checkbox"/> Work alone <input type="checkbox"/> Work in groups	
15	Do you use other digital technologies along with your computer, such as mobile phone or iPad?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	If yes, which one?  What do you do? (for example, surf on the Internet or listen to music)		
		1=Every day 2=A few times a week 3=A few times a month 4=Almost never	
16	I use the computer during lessons to:		
	Play games	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	
	Chat	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	
	Visit communities	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4	
	Other things? Please explain!		
	<b>Own learning</b>		
17	Do you learn things better using a computer?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	Please explain why you chose yes or no!		
18	Are the lessons more fun if you use a computer?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	Please explain why you chose yes or no!		



## Appendix F: Survey - teachers

	Survey - teachers	UNOS UMEÅ - Initial survey - Fall 2011	
	<b>Background information</b>		
1	Sex	<input type="checkbox"/> Male <input type="checkbox"/> Female	
2	Date of birth		
2	Date of teaching degree		
3	Subjects included in teaching degree		
4	I teach the following subjects:		
5	Number of years in teaching	<input type="checkbox"/> 0-3 years <input type="checkbox"/> 3-10 years <input type="checkbox"/> more than 10 years	
6	Experience of 1:1 (one student - one computer project)	<input type="checkbox"/> 0-1 years <input type="checkbox"/> 1-3 years <input type="checkbox"/> more than 3 years	
	<b>Pending the 1:1 - initiative</b>		
7	I participated in ITiS (IT in School)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8	I have ICT skills at this PIM-level	<input type="checkbox"/> PIM 1 <input type="checkbox"/> PIM 2 <input type="checkbox"/> PIM 3 <input type="checkbox"/> PIM 4 <input type="checkbox"/> PIM 5	
9	Compared to other teachers at school, my ICT skills are:	<input type="checkbox"/> Above average <input type="checkbox"/> Average <input type="checkbox"/> Below average	
10	I have previously used ICT in my teaching with students	<input type="checkbox"/> every day <input type="checkbox"/> once a week <input type="checkbox"/> a few times a week <input type="checkbox"/> once a month <input type="checkbox"/> a few times per month <input type="checkbox"/> once a term <input type="checkbox"/> seldom or never	

		(not at all) 1-2-3-4-5 (to a very high level)	
11	I have received professional training with a focus on technology for using ICT in my teaching	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Please explain your answer!		
12	I have received professional training with a focus on pedagogy for using ICT in my teaching	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Please explain your answer!		
13	In what ways do you use ICT in the classroom? Explain, please!		
		(not at all) 1-2-3-4-5 (to a very high level)	
14	I feel well prepared for the integration and use of computers in my teaching	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
15	I feel that most teachers are well prepared for the integration and use of computers at my school	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
16	The 1:1 - initiative at my school has been initiated by:	<input type="checkbox"/> the municipality <input type="checkbox"/> the school leader <input type="checkbox"/> school staff	
17	I have actively participated in the 1:1 - initiative from the idea-stage	<input type="checkbox"/> Yes <input type="checkbox"/> No	
18	I feel that I am involved in the 1:1 - initiative	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<b>Expectations regarding the 1:1 - initiative</b>		

		1=very negative 5=very positive	
19	My expectations regarding the implementation of computers in teaching are:	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
20	How do you plan to use computers in your teaching? Please explain!		
21	I think that computers in teaching will lead to:	1=do not agree at all 3=undecided 5=agree to a high extent	
	Improved ICT skills for my students	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	Improved subject knowledge for my students	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	More efficient work methods for students	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	Improved collaboration between students	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	Increased dialogue in the classroom	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	That students' learning will be enhanced	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	Improved collaboration between students and teachers	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	A calmer classroom environment	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	Other things... Please explain!		
22	I think that students will use computers in the classroom in the following manner:		
	<b>Expectations regarding own learning</b>		
		1=do not agree at all 3=undecided	

		5=agree to a high extent	
23	The 1:1 - initiative will mean improved ICT skills for me as a teacher.	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	Please explain your answer!		
		1=do not agree at all 3=undecided 5=agree to a high extent	
24	The 1:1 - initiative will lead to development in my teaching	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	Please explain!		
25	I see the 1:1 - initiative as a part of my professional development. In what way?	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	<b>The Future</b>		
26	I think that the 1:1 - initiative will have effects on the school organization in the following way (for example, schedule, premises, services etc.):		
27	I think that the 1:1 - initiative will affect my work in the following manner:	1=do not agree at all 3=undecided 5=agree to a high extent	
	Different organization of teaching	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	More planning	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	More administration	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	More documentation	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	More work at home	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	More work at school	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	
	Improved collaboration with other	( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5	

	teachers		
	More efficient work methods	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	New forms of teaching	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Improved collaboration with other teachers	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
28	I think that the 1:1 - initiative will affect the work in the classroom in the following manner:		
29	I think that the 1:1 - initiative will affect the tasks I give to the students: In what way?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
30	The most important factor for succeeding with the 1:1 - initiative is:		
31	The largest hindrance for the success of the 1:1 - initiative is:		
32	Other comments:		
	<p><i>Thank you!</i></p> <p>Your thoughts are very important for this study!</p> <p>If you are interested in participating in an interview (approximately 60 minutes) please fill in your name and telephone number. Thank you!</p>	<p>Name:</p> <p>Phone:</p>	

## Appendix G: Survey - school leaders

	<b>Survey - school leaders</b>	UNOS UMEÅ - Initial survey - Fall 2011	
	<b>Background information</b>		
1	Sex	<input type="checkbox"/> Male <input type="checkbox"/> Female	
2	Date of birth		
3	Education	<input type="checkbox"/> University/Bachelor degree	
		<input type="checkbox"/> University/Master degree	
		<input type="checkbox"/> University/Doctorate	
4	Degree title		
5	Work experience		
	Private sector	<input type="checkbox"/> 0-3 years <input type="checkbox"/> 3-10 years <input type="checkbox"/> more than 10 years	
	Public sector	<input type="checkbox"/> 0-3 years <input type="checkbox"/> 3-10 years <input type="checkbox"/> more than 10 years	
	Manager/school leader	<input type="checkbox"/> 0-3 years <input type="checkbox"/> 3-10 years <input type="checkbox"/> more than 10 years	
	Teacher	<input type="checkbox"/> 0-3 years <input type="checkbox"/> 3-10 years <input type="checkbox"/> more than 10 years	
6	Compared to other school leaders in the municipality, I feel that my ICT skills are:	<input type="checkbox"/> above average <input type="checkbox"/> average <input type="checkbox"/> below average	
	<b>Preparations for the 1:1-initiative</b>		
7	The 1:1- initiative at my school has been initiated by:	<input type="checkbox"/> the municipality <input type="checkbox"/> school leaders <input type="checkbox"/> school staff	
8	I have participated actively in the 1:1 - initiative from the idea-stage	<input type="checkbox"/> Yes <input type="checkbox"/> No	

9	I feel that I am involved in the 1:1 - initiative	<input type="checkbox"/> Yes <input type="checkbox"/> No	
		1=do not agree at all 3=undecided 5=agree to a high extent	
10	The 1:1 - initiative at my school has a clearly formulated aim	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
11	The teachers have received professional training with a focus on pedagogy for using ICT in teaching	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
12	The teachers have received professional training with a focus on technology for using ICT in teaching	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
13	Technical support has been provided at a sufficient level	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	<b>Expectations regarding the 1:1 -initiative</b>	1=do not agree at all 3=undecided 5=agree to a high extent	
14	I am optimistic concerning the 1:1 - initiative	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
15	The teachers at our school are optimistic concerning the 1:1 - initiative	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
16	The students are optimistic concerning the 1:1 - initiative	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
17	I think that computers in teaching will lead to:		
	Improved ICT skills for my students	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Improved subject knowledge for students	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	More efficient work methods for students	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Improved collaboration between	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	

	students		
	Increased dialogue in the classroom between students	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Improved contact between students and teachers	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Computers will enhance students' learning Please explain your answer!	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Improved ICT skills for teachers	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Improved teaching methods for teachers	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	More efficient work methods for teachers	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Increased collaboration between teachers	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	Professional development for teachers	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	New forms of teaching for teachers	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
	<b>The Future</b>		
18	I think that the 1:1 initiative will affect the school's organization in the following manner:		
19	I think that the 1:1 initiative will affect the work in the classroom in the following manner:		
20	I think that the 1:1 initiative will affect my work as a school leader in the following manner:		

21	The most important factor for succeeding with the 1:1 - initiative is:		
22	The largest hindrance for the success of the 1:1 - initiative is:		
	<p><i>Thank you!</i> Your thoughts are very important for this study!</p> <p>If you are interested in participating in an interview (approximately 60 minutes) please fill in your name and telephone number. Thank you!</p>	<p>Name:</p> <p>Phone:</p>	

# Appendix H: Interview guide: students, teachers and school leaders

## *Interview guide - students*

### **Om datorn som arbetsverktyg [Regarding the laptop as a tool]**

Vilka digitala teknologier använder du till skolarbete? På vilket sätt? [Which digital technologies do you use for schoolwork? In which way?]

Hur använder du datorn till skolarbetet? [How do you use the laptop for schoolwork?]

Lär du dig bättre med datorn? Varför/varför inte? [Do you learn better with the laptop? Why/why not?]

Är det roligare att arbeta med datorn? Varför? [Is it more fun to work with the laptop? Why?]

Har du en dator hemma? Vad gör du med datorn hemma? Använder du datorn på samma sätt? Ge exempel! [Do you have a computer at home? What do you use the computer at home for? Do you use the laptop the same way? Give examples!]

Vad finns det för fördelar med att ha en dator? Nackdelar? [What are the advantages of having a laptop? Disadvantages?]

Brukar du ha din dator med dig? Varför/varför inte? [Do you usually have your laptop with you? Why/why not?]

Många elever tar inte med sig datorn. Varför tror du att eleverna inte har datorerna med sig? [Many students do not have their laptops with them. Why do you think that is?]

Kan man jobba i skolan utan dator? Varför/varför inte? [Is it possible to work in school without a laptop? Why/why not?]

Om du skulle beskriva din dator och dig. Hur skulle du beskriva samarbetet? Ge exempel! [If you were to describe yourself and your laptop, how would you describe the collaboration? Give examples!]

**Om hur lärarna arbetar med datorn i klassrummet [Regarding how the teachers work with the laptop in the classroom]**

Hur arbetar lärarna på skolan med datorerna? Ge ett bra exempel och ett mindre bra exempel. [How do the teachers at school work with the laptops? Give a good example and a not so good example.]

Klassens hemsida/LMS: På vilket sätt använder du den? Ge exempel! Saknas det något? [The class website/LMS: How do you use it? Give examples! Is there anything that is missing?]

Hur skulle du vilja att datorerna användes i klassrummet? [How would you like the laptop to be used in the classroom?]

Vad finns det för möjligheter med att arbeta med datorn i klassrummet? [What possibilities are there for working with the laptop in the classroom?]

Vad finns det för problem med att arbeta med datorn i klassrummet? [What problems are there for working with the laptop in the classroom?]

## *Interview guide - teachers*

### **Läraryrollen och syn på lärande [The role of the teacher and view of learning]**

Beskriv din roll som lärare. [Describe your role as a teacher.]

Vad är din viktigaste uppgift som lärare? [What is your most important task as a teacher?]

Beskriv hur du anser att eleverna lär sig. [Describe how you think students learn.]

Finns det några digitala teknologier som du tycker är särskilt bra för elevers lärande? [Are there any specific digital technologies that you think are especially good for students' learning?]

### **Datorer som verktyg [The computer as a tool]**

Hur ser du på 1:1 - initiativet? [What is your view of the 1:1 - initiative?]

Hur tänkte du initialt kring användningen av digitala teknologier i klassrummet? Hur resonerade ni i lärarlaget? Möjligheter och begränsningar? [What did you initially think regarding the use of digital technologies in the classroom? What was the reasoning in the teacher team? Possibilities and challenges?]

Vad var kommunens tanke att digitala teknologier skulle användas till? Vilka kunskaper – ge ett exempel! [What were the municipality's thoughts regarding the use of digital technologies? What knowledge - give an example!]

Hur använde du digitala teknologier i din undervisning innan 1:1 - initiativet och hur använder du dem idag? Till vad och varför? [How did you use digital technologies in your teaching before the 1:1 - initiative and how do you use them today? For what and how?]

Vilka typer/former av kunskaper kan utvecklas hos eleverna genom att de använder digitala teknologier? Vad anser du att de digitala teknologierna kan användas till och inte? Möjligheter/begränsningar?

[What types/forms of knowledge can be developed in students through the use of digital technologies? What do you think digital technologies can be used for and not used for? Possibilities/limitations?

Har användningen av digitala teknologier förändrat dina föreställningar om undervisning och lärande? Varför? Har du på grund av det ändrat/utvecklat din undervisning? På vilket vis? [How has the use of digital technologies changed your ideas about teaching and learning? Why? Have you, as a result of this, changed/developed your teaching? In which way?]

### **Elevernas lärande [Students' learning]**

Hur tror du att användningen av digitala teknologier i klassrummet kommer att påverka elevernas lärande? Elevernas arbete i klassrummet? [How do you think that the use of digital technologies in the classroom will influence students' learning? Students' work in the classroom?]

Vilka möjligheter finns det med att integrera digitala teknologier i klassrummet? Hinder? [Which possibilities are there in the integration of digital technologies in the classroom? Obstacles?]

Hur tänker du kring elevernas datoranvändning under lektionstid som inte gäller skolarbete? Hur tror du att detta påverkar lärandet i klassrummet? [What are your thoughts regarding students' laptop use during lessons that is not related to schoolwork? How do you think this influences learning in the classroom?]

Upplever du detta som ett problem? Vad finns det för lösningar? [Do you see this as a problem? What solutions are there?]

Ibland har inte eleverna sina datorer med sig. Vad tror du att detta beror på? [Sometimes students do not have their laptops with them. What do you think the reason for this is?]

## **Förändringsprocesser [Processes of change]**

Hur ser du på digitala teknologier som ett lärandeverktyg? Lärarlaget? Samsyn? [What is your view on digital technologies as a tool for learning? The teacher team? Collective view?]

Har användningen av digitala teknologier någon betydelse för ditt samarbete med andra lärare? Med eleverna? Föräldrar? [Does the use of digital technologies have any importance for your collaboration with other teachers? Students? Parents?]

Vilken typ av kompetensutveckling anser du är viktigast för att lyckas med användningen av digitala teknologier i klassrummet? [What type of skills/professional development do you think is the most important in order to succeed with the use of digital technologies in the classroom?]

På vilket sätt kan du använda användningen av digitala teknologier som ett sätt att främja din kompetensutveckling/professionsutveckling? [In what way can you use digital technologies as a way to promote your development of skills/professional development?]

Tänk dig tre år framöver. Hur kommer arbetet i klassrummet att påverkas av digitala teknologier? Vilka förändringar kommer detta att innebära för dig som lärare? För eleverna? För skolan? [Think three years ahead. How will the work in the classroom be influenced by digital technologies? What changes will there be for you as a teacher? For students? For schools?]

Hur ser du på digitala teknologier som början av en förändringsprocess i skolan? [What is your view of digital technologies as the beginning of a process of change in school?]

Är det tekniken som driver den pedagogiska utvecklingen eller tvärtom? Varför? [Is it the technology that drives pedagogical development or is it the other way around? Why?]

## *Interview guide - school leaders*

### **Bakgrund [Background questions]**

Beskriv din bakgrund och din väg till den tjänst som du har. [Describe your background and your way to your present position.]

Beskriv hur du ser på IT - utvecklingen inom skolans värld. [Describe you view of the IT - development within the school environment.]

Beskriv utvecklingen fram till 1:1 - initiativet. [Describe the development prior to the 1:1 - initiative.]

Hur resonerade ni i ledningen om hur själva implementeringen skulle ske? Vilka organisatoriska övervägande gjordes och varför? [What was the management's reasoning regarding how the implemetation itself was to take place?]

Vilka styrdokument finns upprättade för 1:1 - processen? Hur följs de upp? [What steering documents were set up for the 1:1 - process?]

### **Om digitala teknologier i klassrummet [Regarding digital technologies in the classroom]**

Vilka förändringar har du sett? [What changes have you seen?]

Vad är målet med projektet? Hur fångar du/ni som rektorer upp lärarnas och elevernas syn på att använda digitala teknologier/datorn i undervisning och lärande? Förs det en aktiv dialog mellan ledning och lärare i dessa frågor? [What is the aim of the project? How do you as a school leader capture students' and teachers' views on using digital technologies/the laptop in teaching and learning?]

Vad tycker du att det innebär för elever, lärare, rektorer och för skolan som organisation när digitala teknologier integreras på bred front i undervisningen? [What do you think the widespread integration of digital technologies in teaching will mean for students, teachers, school leaders and schools as organizations?]

Vilka utbildningsinsatser har gjorts? Varför just de utbildningsinsatserna?  
Vilka planeras för och varför? [What efforts in training/education have  
been made? Why exactly these training/educational efforts?]

Vad finns det för hinder med digitala teknologier i klassrummet? [What  
obstacles are there regarding digital technologies in the classroom?]

Vad finns det för möjligheter med digitala teknologier i klassrummet?  
[What possibilities are there regarding digital technologies in the  
classroom?]

## **Included Articles**