MOBILE PHONES IN SCHOOL

From disturbing objects to infrastructure for learning

Studies in Applied Information Technology, September 2017

MOBILE PHONES IN SCHOOL
From disturbing objects to infrastructure for learning

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Doctoral Dissertation

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ISBN: 978-91-88254-01-4
ISSN: 1652-490X

Doctoral Thesis in Applied Information Technology towards Educational Science, at the Department of Applied IT, University of Gothenburg.

The thesis is available in full text online
http://hdl.handle.net/2077/53361

This doctoral thesis has been prepared within the framework of the graduate school in educational science at the Centre for Educational and Teacher Research, University of Gothenburg.

Centre for Educational Science and Teacher Research, CUL
Graduate school in Ecuational Science
Doktoral thesis No. 65

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Printed in Sweden by Kompendiet

ABSTRACT

Title: Mobile phones in school: from disturbing objects to infrastructure for learning
Language: English with a Swedish summary
Keywords: mobile phone, upper secondary school, teachers, students, public debate, infrastructure for learning
ISBN: 978-91-88254-01-4
ISSN: 1652-490X

Amid digitalisation, the mobile phone has pervaded society and become one of the most widespread digital technologies. In school, the mobile phone has stirred up conflicts and tensions visible in public debate as well as classrooms. Teachers and students have struggled to manage mobile phones within the boundaries of school practice. This thesis explores these conflicts and tensions surrounding mobile phones in upper-secondary school. Theoretically, the analysis is based on the sociocultural perspective and views school as a social practice that builds on the installed base of infrastructure compiled from material and social resources and on institutional arrangements assigned or designed to support learning.

The empirical foundation of this thesis comprises four separate studies. Together, they present a mixed-methods approach to address the tensions surrounding mobile phones in school as they have arisen in public debate and in teachers and students' viewpoints. The results show that banning the use of mobile phones in school is an issue that politicians have used in the debate. Teachers have been equipped with legislation allowing them to ban the use of mobile phones when they are disruptive or threaten education. Nevertheless, many teachers permit students to use their mobile phones when the use is compatible with schoolwork. Students often use their mobile phones for school-related activities but struggle to balance their use with the conventions of school practice.

The mobile phone challenges school practice and education in many ways, for example, in classroom roles, curriculum implementation and control over education. Despite these challenges to school practice from mobile phones, the results show that both teachers and students use many features of the devices to support schoolwork. Thus, despite these challenges and tensions, the mobile phone has become part of schools' infrastructure for learning.

ACKNOWLEDGMENTS

Writing this thesis would not have been possible without the love, support and joy from other people. Thus, I would like to take the opportunity to express my gratitude to all the people I have had the pleasure to meet over these years at the University of Gothenburg, I will here mention some of you in particular.

First, I would like to thank my mom and dad, for inspiring me and for always believing in my abilities. They have also made this thesis possible by the provision of support in all the small things in life, such as looking after Roy and Irma when their parents have been working late. I would also like to thank my father in law Allan Leveau, for always keeping up a good spirit, and showing appreciation for the essential things in life like a cold beer and a nice talk.

To my supervisors Alexandra Weilenmann, Johan Lundin and Berner Lindström, I would like to express my special gratitude for their patience, encouragement and for the many intellectually stimulating talks. You are truly great people.

Through the department of applied IT and the division of Learning, Communication and IT I have met a lot of nice, intelligent and interesting people over the years. Thank you Anne Algers, Wolmet Barendregt, Linda Bradley, Leona Bunting, Lu Cao, Katerina Cerna, Lena Dafgård, Karin Ekman, Mattias von Feilitzen, Åsa Fyrberg, Anna-Lena Godhe, Anita Grigic Magnusson, Therese Haglind, Thomas Hillman, Ylva Hård af Segerstad, Jens Ideland, Beata Jungselius, Niklas Karlsson, Fredrika Lagergren Wahlin, Jonas Landgren, Annika Lantz-Andersson, Patrik Lilja, Thomas Lindroth, Jia Lu, Mona Lundin, Johanna Lönngren, Lisa Molin, Urban Nuldén, Catarina Player-Koro, Marisa Ponti, Agneta Ranerup, Elizabeth Reitz, Sofia Serholt, Sylvana Sofkova Hashemi, Igor Stankovic, Dick Stenmark, Lars Svensson, Martin Tallvid, Marie Utterberg and Anne Öhman. Thanks also to Mikael Morin for always solving, basically any problem related to my computer, and to Pär Meiling for always seeking to improve the situation for the Phd-Candidates at the department. I must neither forget to express my gratitude to all the administrative staff whose daily efforts make the work run smooth at the department of applied IT.

My research would not have been possible without the financing from The Linnaeus Centre for Research on Learning, Interaction and Mediated Communication in Contemporary Society - LinCS; The Centre for Educational Science and Teachers Research - CUL; and DigitaL – Learning in the digitalized region; Thank you very much for providing me with this opportunity. Through DigitaL I have had the pleasure to come in contact with many interesting researchers and Phd-candidates at the University West in Trollhättan. Thank you for widening my perspectives on IT and learning in the digitalised work life.

I would also like to say thanks Teresa Cerratto Pargman and Stefan Hrastinski for their valuable comments on my manuscripts at the mid and final seminars.

Thanks also to all the nice people that I have met when I was working together with Mölndal: Christer Ferm, Camilla Rudevärn, Martina Borg, Line Kavmark Knieling, Helene Klasohn Renlund, Leo Contreras, Mahroo Khousravi, and Per Skoglund at the SPSM.

I am of course also very grateful to Anders Kjellberg, Stina Blind, and all the students and teachers that agreed to participate in the studies.

Finally, Ullis my love, thank you for always supporting me. When I have had doubts in myself, you have told me that everyone else is wrong.

Sävedalen August 2017
Torbjörn Ott

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PART II - THE PAPERS

Part I

MOBILE PHONES IN SCHOOL

CHAPTER 1
INTRODUCTION

This thesis explores the tensions that have surrounded the mobile phone in school practices. These tensions have arisen during the spread of the mobile phone through all groups in society since the 1990s. The mobile phone has emerged as one of the most widespread digital technologies among both adults and adolescents (Katz, Felix, & Gubernick, 2014; Merchant, 2012; Traxler & Vosloo, 2014). Its ubiquity has more profound significance than the number of mobile phones present. The mobile phone is a material representation of the on-going digitalisation. One should not mistake digitalisation for merely a shift from using analogue technologies to using digital technologies. It has had profound impacts on the way of life. Societal functions and work-related and social practices are in a continuous process of adaptation to the use of digital technologies (Brynjolfsson & McAffe, 2014). So is education, and vast investments have been made to equip educational institutions with digital technology (Cuban, 2013).

However, the connection between the design and the investment in technology and its actual use in practice is anything but straightforward

(Star & Bowker, 2006). In Sweden, this has been reflected in the many initiatives launched to promote the use of digital technology in schools (Grönlund, 2014). Over history, these often have been encouraged by the government through policy and funding (Tallvid, 2015). Separate computer labs and classroom computers were once common, but during the past decade, these have often been replaced by the distribution of computers or tablets to students on a one-to-one basis (Perselli, 2014; Tallvid, 2015). In 2015, as many as 3 of 4 upper-secondary students in Sweden were provided with their own personal computers by their schools to use in the education (Skolverket, 2016a). Internationally, these one-to-one projects have led to massive investments by schools, but due to the high costs of one-to-one projects, bring your own device (BYOD) initiatives have become a practiced alternative (Parsons & Adhikari, 2016).

At the same time that schools have made investments to digitise education, students have brought their own technology, primarily mobile phones, to school. However, this pattern has not been part of any BYOD initiative but, instead, the conduct of students' everyday lives, in which mobile phones have become more and more central. In Sweden, nearly every upper-secondary student has a mobile phone in their possession (Alexanderson & Davidsson, 2016). When students go to school, they bring their mobile phones and find ways to use them in schoolwork (Ott, Haglind, & Lindström, 2014; Ott, Grigic Magnusson, Weilenmann, & Hård af Segerstad, 2017b; Thomas & Muñoz, 2016). However, the mobile phone has turned out to be a difficult technology for schools to handle. The presence of mobile phones and students' use of them have generated public debate (Johnson & Kritsonis, 2007; Olin-Scheller & Tanner, 2015; Ott, 2014), as well as academic interest (Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sánchez, & Vavoula, 2009). This thesis studies upper-secondary school, but previous research on technology use in both lower (see e.g. Selwyn & Bulfin, 2016) and higher levels (see e.g. Şad & Göktaş, 2013) of the education system indicate that these tensions occur throughout the education system.

Research on mobile learning acknowledges that mobile phones and other digital technologies, such as tablets, hold great potential as tools for learning inside and outside school (Crompton, 2013a; Kukulska-Hulme et al., 2009). Indeed, the issue of how to deal with mobile phones in school

has several layers beyond the mere presence of the devices in school. The issue follows as a consequence of digitalisation and, therefore, is also a matter of the impact digitalisation has on school and whether schools will adapt to societal changes or be a shelter from the turmoil of the lifeworld outside the classroom (Pachler, Bachmair, & Cook, 2013). In the public debate, the mobile phone has been described mostly as distracting and disturbing to the learning environment in schools (Ott, 2014). In Sweden as well as internationally, legislation to limit students' access to technology has been passed to overcome the distractions and disturbances caused by mobile phones in school (Gao, Yan, Zhao, Pan, & Mo, 2014; Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sánchez, & Vavoula, 2011; O'Bannon & Thomas, 2015; Ott, 2014). The result has been a situation in which teachers and students are encouraged to use some technologies in which schools need to invest. At the same time, teachers have been equipped with legislation to use to support actions regarding the use of mobile phones, a technology already present in the learning environment.

For legislation to have impact on practice, it needs to be enforced by someone (Charles, 2012). In the classroom, teachers implement legislation to decrease the distractions and disturbances from mobile phones. However, all teachers do not perceive use of mobile phones or technology in education in the same way, and the actual classroom implementation of policy is negotiated in practice (Charles, 2012; Cuban, 2013; Rasmussen & Ludvigsen, 2009; Selwyn & Bulfin, 2016). Through implicit negotiations in practice, social and cultural factors, including the values and beliefs of individual stakeholders such as teachers, students, parents and policy makers, influence school practice (Giroux & Penna, 1979). Consequently, teachers execute legislation in different ways. This has created the emergence of a sort of boundary space (cf. Star, 2010) where students have to adjust their use of mobile phones to different teachers' individual enforcement of legislation.

To explore the tensions surrounding the mobile phone in school practice, the matter should be addressed from a perspective that acknowledges the number of stakeholders involved and the role of technology in social practices. In this thesis, these tensions are analysed from a sociocultural perspective. School practice is understood as a social practice that builds on an installed base of infrastructure constructed from materials and

social resources and on institutional arrangements assigned or designed to support learning (Guribye & Lindström, 2009).

The notion of infrastructure (Star & Ruhleder, 1996) is used as an analytical tool to conceptually synthesise the studies discussed in this thesis. The infrastructure for learning reaches beyond school, so the viewpoints of stakeholders, both internal and external to school, need to be acknowledged. External stakeholders have on many occasions in public debate expressed their opinions regarding the mobile phone in school. Studying the public debate prior to and following the first Swedish legislation targeting mobile phone in schools, therefore, can provide both an account of these stakeholders' perceptions and a historical review of the emergence of the tensions (Ott, 2014). Students and teachers are the central stakeholders in schools shaping practice. Teachers have been given the legal authority to take actions to deal with mobile phones in schools, so their use of that authority and the diversity of their perceptions of the mobile phone in school and the classroom become crucial to this study (Ott, Lundin, & Lindström, 2017a).

The heart of the matter, however, is the mobile phones that students bring to school; therefore, students' viewpoints must be taken into account. Upper-secondary students' own reasoning about using their mobile phones in school despite legislation should not be neglected (Ott et al., 2017b). At the same time that students use mobile phones as an infrastructural resource for learning in school, these devices open up the social world (Phelan, Davidson, & Cao, 1991) of school for participation in other social worlds where other conditions govern participation. It, therefore, is of interest to address students' different perceptions of the mobile phone in the social world of school and the social worlds outside school (Ott et al., 2014). In this thesis, these concerns are addressed.

1.1 RESEARCH AIM AND QUESTIONS

The aim of this thesis is to critically scrutinise the mobile phone[1] as a tool for learning in upper-secondary school. To achieve this aim, three research questions are formulated to guide the analysis. These research questions are addressed in four separate studies.

1. What tensions surrounding the mobile phone in school practice are reflected in public debate?
2. What factors affect teachers' permission for students to use mobile phones during lessons?
3. How do students perceive the mobile phone as a tool in school practice?

1.2 THESIS OUTLINE

This thesis is divided into two parts. The first part consists of the cover essay, and the second part of four research papers. In the cover essay, the first chapter presents the introduction, followed by the research aims and questions and a brief introduction to the problem area and the research design. The second chapter covers the background of the research area of mobile learning, the formal Swedish policy regarding mobile phones in school and previous research regarding the use of mobile phones in school. In the third chapter, the sociocultural theoretical foundation, the infrastructural perspective and its application to schools are elaborated. In the fourth chapter, the research design is presented, along with some methodological considerations. In the fifth chapter, the four empirical studies are summarised. The sixth chapter explores the research questions based on the empirical findings and discusses the findings in relation to school practice and the notion of infrastructure.

The second part of the thesis consists of the following studies:

1 In the thesis, the term *mobile phone* includes both the smartphone and the basic mobile phone unless a specific point demands a specific definition of the type of mobile phone.

1. Ott, T. (2014). A historical materialist analysis of the debate in Swedish print media on mobile phones in school settings. *International Journal of Mobile and Blended Learning, 6*(2), 1–14.
2. Ott, T., Haglind, T., & Lindström, B. (2014, 3-5 November 2014). Students' use of mobile phones for schoolwork. In: M. Kalz, Y. Bayyurt, & M. Specht (Eds.). *Mobile as mainstream—towards future challenges in mobile learning: 13th World Conference on Mobile and Contextual Learning, mLearn 2014 Istanbul, Turkey, November 3–5, 2014, proceedings* (pp. 69–80). Istanbul, Turkey: mLearn 2014.
3. Ott, T., Lundin, J., & Lindström, B. (2017a). *Unintentional integration of technology—teachers' attitude and permission of mobile phones as tools for learning in the classroom*. Manuscript in preparation.
4. Ott, T., Grigic Magnusson, A., Weilenmann, A., & Hård af Segerstad, Y. (2017b). "It must not disturb; it's as simple as that": Students' voices on mobile phones in the infrastructure for learning in Swedish upper secondary school. *Education and Information Technology*. https://link.springer.com/article/10.1007/s10639-017-9615-0

CHAPTER 2

BACKGROUND

A review of the evolution of the utilisation of information and communication technology (ICT) in school contexts provides a necessary foundation for the further elaboration presented in this thesis. The use of tools for learning in school is not a novelty, and this chapter begins with a historical outline of initiatives to supply ICT to educational institutions in Sweden. However, the mobile phone is the technology in focus in the present studies, so the chapter continues with a general discussion of what defines the mobile phone in relation to other mobile technologies. Next, a review of Swedish policy documents (e.g. the national curriculum regarding the use of mobile phones in upper-secondary school) follows. Then, the mobile learning research field and some implications of mobile learning for formal education are presented, and finally, previous research on the use of mobile phones in education is reviewed.

2.1 REVIEW OF INITIATIVES TO PROVIDE ICT TO SWEDISH SCHOOLS

During the twentieth century, several waves of ICT have washed over schools. Film, radio and TV were all technologies celebrated in their contemporary time as transformers of traditional education. The proponents of technological changes often held high positions in society but lacked formal connections to the school system. Inventor Thomas Alva Edison is among numerous examples of proponents of the idea that formal education has to be infused by technology to meet the demands of the future. In the 1920s, Edison was convinced of the necessity of using film in education (Cuban, 1986). However, school organisation has remained more or less the same throughout the various technological tides. The teacher in the classroom teaching students according to the curriculum has not disappeared (Cuban, 2001).

Cuban's (1986) analysis, though, is criticised for emphasising the stability of school activities and for using an 'ideal use of ICT as analytic yardstick' (Rasmussen & Ludvigsen, 2009, p 90). Moreover, Rasmussen and Ludvigsen (2009) critique Cuban (1986) for using an input–output approach that black boxes how schoolwork is carried out, overlooks changes at the micro level and ignores changes caused by the ICT used in activities. However, the mechanism described by Cuban (1986) is not irrelevant and can still provide knowledge of how school and teaching traditions respond to change. Even with the flaws demonstrated by Rasmussen and Ludvigsen (2009), the scenario described by Cuban (1986) is applicable to some extent and has a counterpart in Sweden, portrayed in a historical exposé by Karlsohn (2009).

Sweden was one of the first countries to recognise the potential of using digital technology in schools (Tallvid, 2015). During the 1970s, Swedish schools conducted experimental trials with computers under the National Agency of Education and concluded that computers could be used in school. The 1980 curriculum, Läroplan för grundskolan (LGR80), stipulated that students should learn about computers and how they function. Consequently, in 1984, schools introduced the subject *Datalära*, or 'education about, with and from computers' (Riis, 2000, p. 11). With joint funding from the national government and municipalities, every second-

ary school in Sweden was equipped with a computer hall with approximately eight computers (Riis, 2000). Teachers were also encouraged to take an interest in computers (Karlsohn, 2009). Computer education was most often carried out in the context of math or science by the teachers of those subjects (Riis, 2000).

During the 1980s, international and domestic philosophers and intellectuals proclaimed that the civilised world was transitioning from an industrial society to an information society. The transition would inevitably influence schools and education, and the hazards of a substandard national educational system were expressed. In his historical analysis, Karlsohn (2009) puts forth an argument that circulated in the debate regarding technology in schools: if Sweden were to avoid falling behind in international economic competition, teachers' role as educational leaders and a source of knowledge had to change. Teachers needed training to become teachers in the computer age. During this same period, the development of word processors made the use of computers a concern for teachers in a wide range of subjects, including language (Riis, 2000).

In the early 1990s, responsibility for the operation of schools was shifted from the federal government to municipal governments. At the same time, Sweden entered an economic recession, and schools were forced to make large savings. In this context, computers were regarded as a means to rationalise and streamline teaching. Teaching staff was generally sceptical and reluctant, but municipal funders generally believed that computers would be used if technology were in place. Funding for computers in school remained relatively stable during the years of the crisis (Karlsohn, 2009; Riis, 2000). A view on this situation in schools is expressed in the public document SOU 1994:45 *Foundation for lifelong learning*. It states that the recipe for Swedish schools is to:

> Replace the desk with the computer, and let the students actively work with it as a tool for knowledge acquisition. The teacher is accordingly to be converted to a 'mentor and guide'. (SOU, 1994, p. 45, as cited in Karlsohn, 2009, p. 115, author's translation)

This formula was a call for a computer-induced transformation of teachers' role.

In 1994, the Foundation for Knowledge and Competence Development (KK-Stiftelsen) was established. It was governmentally supported through the decommissioned wage-earner funds (Tallvid, 2015). Initially, the foundation invested in 25 selected schools to provide rigorous resources for building a technological infrastructure for the implementation of ICT. The initial main projects were called *Lighthouse Projects*. The premise was that the selected schools would lead the way and inspire others to follow. Critics alleged that the project was permeated by opportunism alongside a lack of planning and realism. When the project ended, differences between municipalities that received and did not receive funds were hard to detect (Karlsohn, 2009). In parallel to the Lighthouse projects, KK-Stiftelsen also invested in a variety of 85 smaller school-development projects.

The next major government-funded project was Information Technology in School (ITiS), launched in 1998. By then, ICT in schools was considered to be a democratic issue. The government stated that:

> A general and high level of education with a focus on lifelong learning will provide an information and knowledge society where all citizens are given the opportunity to take advantage of IT's potential. (Prop 1995/96:125, as cited in Karlsohn, 2009, p. 130; author's translation)

ITiS came to be the largest single investment in ICT in Swedish schools and was funded by the government and KK-Stiftelsen. In ITiS, teachers were grouped in teams with municipal advisors to assist them develop skills. The teachers were provided with their own personal computers (PC) with the intent for the teachers to learn how to use them. Later, ITiS was merged into the Agency for School Development. After ITiS ended in 2003, the Agency for School Development in 2006 initiated Practical IT and Media Skills, a self-study programme which trained teachers in handling certain software.

During the recovery after the economic crisis in the early 1990s, the Swedish IT companies sector started to grow. Along with national economic growth came confidence in knowledge of the direction of the development of society and school. In the public debate, IT industry representatives often stated that schools were falling behind the rest of the

society and that teachers had become fossilised. Schools had to be modernised through ICT. As Karlsohn (2009) highlights, the public debate was heavily dominated by proponents of the massive computerisation of school.

The importance of IT for a prosperous future was also acknowledged in governmental policy through investment in broadband infrastructure and the home PC reform of 1998. The home PC reform was a government-funded programme that allowed all those holding employment to borrow home computers and later buy them at favourable prices. The investments in broadband infrastructure and the home PC reform achieved significant progress in making Swedish society connected (Wiklund, 2015).

However, even if computers spread to Swedish homes, the pedagogical gains from the ICT investments in schools were limited. The total and, as proponents of technology claimed, necessary transformation of schools through investments in computers did not occur (Karlsohn, 2009). Investments in ICT that failed to transform school practice as expected were not unique to Sweden but had counterparts across the western world (Karasavvidis, 2009). When the IT bubble burst in 2000, many IT companies went bankrupt, and from that point on, debate over ICT in school became more nuanced (Karlsohn, 2009).

Cuban (1986) and Karlsohn (2009) both find a lack of evidence for the transformation of school practice due to technological advancements. Changes in productivity due to the introduction of technology have been difficult to validate. A lack of knowledge of what should be measured is one factor making gains difficult to prove. As well, results are often expected in a short time, gains in one area can be a cost in another and blur the overall picture, and conceptualising information and gains from technology is complex (Brynjolfsson, 1993).

Meanwhile, new models to supply students with ICT have been developed internationally. In 2002, the state of Maine became among the first school systems to distribute laptops to students on a 1:1 basis as 40,000 high school students were each given a laptop. Soon, other countries followed. In Sweden, early municipalities to invest in 1:1 laptop programmes were Falkenberg and Gislaved. Today, 1:1 programmes do not necessarily involve laptop computers but the distribution of one device per student in a connected environment, regardless of whether the device is a laptop

or a tablet (Tallvid, 2015). Grönlund (2014) states that three main reasons usually motivate 1:1 investments: first, the computer is a modern tool that everyone uses and, needless to say, should also be used in school; second, the use of computers enhances education; and third, computers provide more education for less money. According to Grönlund (2014), the first reason is quite obvious, except for the expenses, while the second is complex, and the third is a misconception.

2.2 WHAT MAKES A MOBILE PHONE

In recent decades, telecommunications and information technologies have become increasingly intertwined and integrated. Interconnected networked systems consisting of a variety of applications and systems have emerged (Guribye, 2005). Today, the mobile phone is an integrated technology that enables many functions beyond conversational communication (Agar, 2013). Outside school, the mobile phone has been increasingly integrated into the infrastructure of many social practices (Merchant, 2012; Traxler & Vosloo, 2014). Indeed, the mobile phone has become a social and organisational necessity for adolescents and adults in all socioeconomic groups. In lower-income groups, the mobile phone is even the most common technological platform owned (Katz et al., 2014).

Even if the mobile phone has proven to be highly useful in modern life, the integration of the mobile phone into school practice has been hindered by conflicts. Schools have invested large amounts into supplying students with infrastructural resources such as laptops and tablets, but at the same time, schools have tried to restrict students from using their personal technology which on many occasions could enable the same functionality as computers and tablets. This thesis elaborates on how the mobile phone in general can be understood to distinguish it from other mobile technologies, such as laptops and tablets. The differences in how the mobile phone and other technologies are perceived in school are an implicit foundation for the studies in this thesis. However, some more general distinguishing features deserve to be discussed; for example, the general manner of usage has been identified as a difference. In the context of mobile learning, the mobile phone, unlike the laptop, is a technology that the user carries without a predesignated purpose (Traxler, 2007).

Until the smartphone was released in the markets, a significant difference between the mobile phone and the laptop or the desktop computer was that the functions of the mobile were those the manufacturer built into it (Traxler, 2007).

However, with the development of the smartphone and applications, the mobile phone has become customisable like laptops and desktop computers. Users are no longer solely dependent on the work of the hardware manufacturer for the functionalities of their personal mobile phones. The smartphone has become a more personalised device. It is now an electronic device that the users can customise and fill with software and applications (Bjärvall, 2011). The mobile phone is still brought along without *one specific* predesignated purpose but instead provides its user with a myriad of services throughout the day. Technologies such as cameras, music players and calendars have been integrated into the mobile phone, and many new services, functions and social arenas have been developed for use in mobile phones. In fact, not having a mobile phone makes participation in many social practices of modern life difficult as these have been adapted to presence of the technology (Agar, 2013).

Then there is the tablet. It can be disputed whether there even are significant differences between tablets and smartphones. The differences from a technological perspective can be summed up as mainly concerning size and connectivity. There are no clean-cut lines here, though, and beyond the material appearances, there are social layers that can be addressed only in relation to different practices and contexts. The larger size of the tablet allows tasks that demand more of a visual overview to be carried out on the device, but the smaller size of the mobile phone allows it to be brought along without too much trouble. The size of the mobile phone is still large enough to satisfy the needs of users. In the pre-smartphone era, size was the ultimate selling proposition for manufacturers, and the competitive standard was the smaller, the better. The size of the device reflected the level of both technological performance and mobility (Agar, 2013). Smartphones, in contrast, come in various sizes, and there are tablets almost similar in size and appearance. The similarities continue in the technology underneath the surface. Both tablet and mobile phones are connected to the Internet. However, whereas mobile phones as a standard use 3G, 4G and Wi-Fi to access the Internet, tablets typically

rely on Wi-Fi. However, more advanced tablets can use 3G or 4G connections to the Internet. Despite these standard differences in connectivity, with the development of services for synchronous communication such as Messenger, Facetime and Skype, tablets can even be used for the signature feature of mobile phones: making phone calls.

Nevertheless, mobile phones are more widespread. In Sweden, 86% of upper-secondary students have access to a tablet in their home, while 98% have a smartphone in their own possession (Alexanderson & Davidsson, 2016). However, schools have had difficulties adjusting to the ubiquity of the mobile phone. This is seen in the fact that schools have distributed laptops and tablets but not mobile phones to students with the purpose of supporting students' learning (Perselli, 2014; Tallvid, 2015). Nevertheless, the mobile phone is still present in school. Functionality *per se* does not seem to be the decisive factor in what technology is used in school. This thesis relies on a foundational understanding of socio-materiality, acknowledging that the material and the social are intertwined (Orlikowski, 2007). To move beyond the tangled instrumental understanding of what distinguishes mobile technologies, it is important to recognise the mobile phone as a cultural resource which has a particular history (Pachler et al., 2013). The differences between the mobile phone and other mobile technologies emerge from the contextualised perceptions of the mobile phone in school.

2.3 SWEDISH POLICY ON MOBILE PHONES IN SCHOOLS

The national Swedish curriculum for upper-secondary school (Skolverket, 2013) states that schools should prepare students to live in a changing world where new technologies have impacts on social practices and where technology is essential in the development of local and global society. Digital tools are used in several practices, and it is the head teacher's responsibility to provide students with access to technological tools that aid in searching for information and achieving learning. Among the overall knowledge goals of the upper-secondary school, the curriculum states that:

> It is the responsibility of the school that all individual students: […] can use books, library resources and modern technology as a tool in the search for knowledge, communication, creativity and learning. (Skolverket, 2013, pp. 8–9)

Even though new technology is ascribed significance in the national curriculum for upper-secondary school, the curriculum does not specifically address mobile phones. That does not mean that there is no formal policy on the use of mobile phones in Swedish upper-secondary school. In 2007, after years of debate (see Ott, 2014), the Swedish government passed a law giving teachers in compulsory and upper-secondary school the authority to confiscate objects they deem to be disturbing or dangerous. Mobile phones are classified as such objects.

> Head teachers or teachers can confiscate from students objects that are used in a manner disturbing to education or that can threaten security in the school.
>
> The head teacher cannot commission someone else to make the decision in accordance with the previous section. (SFS. 2010:800, author's translation)

The school law allows teachers to keep confiscated objects for the entire school day. If disturbances recur frequently, teachers shall notify students' guardians and may keep confiscated objects for a maximum of four days. Confiscation shall be documented by teachers unless the objects are returned to students at the end of the lesson (SFS. 2010:800). The juridical guidance issued by the National Agency of Education states that this law may be applied throughout the school premises and not only in the classroom. Skolverket (2014) contends that mobile phones can be disturbing objects, but they do not have to be disturbing if they are turned off. However, if they are used for cheating or in a manner that makes schoolwork more difficult, they are classified as disturbing.

The boundaries of the law were tested in practice in 2014 when the head teacher at a junior secondary school decided to implement a total ban on the use of mobile phones during school hours. The reason for

the ban was that students had taken photos of each other in locker rooms and posted the photos on the Internet. Calling and texting during lessons were also frequent disturbances in the school. However, the decision was appealed to the Swedish school inspectorate. After an investigation, the Swedish school inspectorate described the ban as appreciated by students, faculty and parents. The students at the school could still use their mobile phones during lessons if teachers permitted it. The school inspectorate decided that the banning had been an adequate measure. However, the head teacher should have engaged students in designing the school's conduct regulations (Skolinspektionen, 2016). Thus, mobile phones are not banned from schools by any law in Sweden, but legislation allows for schools to implement their own local policies banning mobile phones from school.

Despite the current situation in schools, the developers of future policy acknowledge that the mobile phone is a potential resource for pedagogical work in school. For example, in 2015, the Swedish government requested that the National Agency of Education suggest national strategies for the use of ICT within school systems. The strategies should work to support the ethical use of ICT in education and school development by all faculty and staff and the development of digital competence and innovation (with extra emphasis in upper-secondary school on digital competence to meet the demands of the business world and higher education) (Knutsson, 2015). In response, the National Agency of Education recommended that curricula be revised to better support the development of digital competence (as defined by the European Commission, 2007) and programming skills (Skolverket, 2016b). In the extended report (Skolverket, 2016c), mobile phones and pedagogical apps are suggested as tools for students' toolbox for schoolwork. BYOD policies are also discussed as an emerging approach to supply students with technology as interest in 1:1 projects is decreasing.

2.4 BRING YOUR OWN DEVICE

BYOD, bring your own software (BYOS) and bring your own technology (BYOT) approaches all build on the agency of the user to choose and use technology not provided by the institution or the workplace where a task

is to be carried out (Ghosh, Gajar, & Rai, 2013). Choose your own device is another variation on this concept which differs from BYOD, BYOT and BYOS by using technology owned by the workplace or the institution but chosen by the user. All of these approaches allow the user agency in choosing technology suitable for the task, in contrast to the use what you are told approach (Brodin, 2016).

In the educational context, BYOD seems to be the dominant approach in use. In its purest form, the BYOD approach implies that students may use any technology they have in their possession to solve assignments (Jaldemark, 2013). In such a BYOD approach, pedagogical considerations are put before regulations regarding what technology may be used (Cochrane, Antonczak, Keegan, & Narayan, 2014). However, the reality is that when implementing a BYOD policy, schools can recommend a specific technology for parents to allow students to bring (Adhikari, Parsons, & Mathrani, 2012). The mobile phone is one technology that appears to have a potential future within the BYOD approach in schools (Jaldemark, 2013; Norris & Soloway, 2011; Sharples et al., 2014). Thomas and Muñoz (2016) note a trend that US schools have started to repeal bans on mobile phones and encourage a BYOD approach.

The motives for BYOD approaches can be economic as it is expensive to provide personal laptops or tablets to all students. There are also more pedagogically motivated drivers, such as the desire to keep schooling relevant to students in a society increasingly dependent on the use of technology. Make the use of ICT more integral to education and less of an exception can also be a motivation to implementing a BYOD approach (Parsons & Adhikari, 2016). By facilitating more personalised and self-directed learning, the BYOD approach can challenge school practice, making it more learner centred (Norris & Soloway, 2011). Such challenges have been described in terms of the emergence of a new culture of learning in which networked technology makes students' learning more individualised, putting pressure on formal education to recognise students' social practices as important learning arenas (Thomas & Brown, 2011). BYOD can also come into play as schools pick up on mobile learning (Parsons, 2017). In Swedish schools, BYOD approaches have so far been held back by arguments based on the idea of equal education as stated in the school law (SFS 2010:800). If the schoolwork demands the use of technology, then schools must provide all students with equal technology.

2.5 MOBILE LEARNING

Research within the mobile learning field studies the use of mobile technologies for learning. Historically, research on mobile learning follows two tracks: a *mobile*, technology-driven track and a pedagogical *learning* track (Crompton, 2013a). Mobile learning requires more than the mobility of technology or the mobility of learners. In mobile learning, there must be interaction between the focus on the learner and the focus on technology (Vavoula, Sharples, Scanlon, Lonsdale, & Jones, 2005). This section presents mobile learning as it is understood and used in this thesis. First, the understanding of mobility is explained, and then a brief history of the technological-infused development of the field is presented. Next, some aspects of mobile learning in formal learning settings are discussed, along with a review of research on students' use of mobile phones in school.

Fundamental to mobile learning is the understanding of mobility as physical, contextual and temporal (Kakihara & Sørensen, 2002). In mobile learning, these three mobilities imply the mobility of learners (a person can engage in learning independent of physical location), the mobility of technology (the technology can be used on the move), mobility within conceptual space (connectivity allows engaging in learning independent of the contextual surroundings), social mobility (a person collaborates with other people and communities independent of their physical presence) and learning dispersed over time and in and out of engagement with technologies (Sharples, Taylor, & Vavoula, 2007).

Building on this understanding of mobility, this thesis relies on the definition of mobile learning as 'learning across multiple contexts, through social and content interactions, using personal electronic devices' (Crompton, 2013a, p. 4). Centred on context, social and content interaction and mediation through electronic devices, Crompton's (2013a) definition is highly sociocultural and acknowledges the situated nature of meaning making mediated through artefacts. This view is compatible with the description of mobile learning as 'the processes of coming to know and being able to operate successfully in, and across, new and ever changing contexts and learning spaces' (Pachler, Bachmair, & Cook, 2009, p. 6). The claim that the research presented in this thesis belongs within the research field of mobile learning relies on the sociocultural understanding

of mobile learning. Building on this definition, mobile learning is learning that can be directed by oneself or others. The physical environment may or may not impact the learning activity, but a mobile electronic device must be utilised. Thus, mobile learning can be an activity situated in a formal learning setting such as a classroom but also an informal, spontaneous act of curiosity on the move (Crompton, 2013a).

Central to the concept of mobile learning is the ability, supported by mobile technologies, to engage in learning activities *anywhere,* at *any time* or *whenever* and *wherever* (Arrigo, Kukulska-Hulme, Arnedillo-Sánchez, & Kismihok, 2012; Motiwalla, 2007; Sharples, 2002; Traxler, 2007). Research on mobile learning studies the creation of learning environments and makes contemporary accounts of what counts as factors enabling learning. Mobile learning research targets learning that is learner centred, adopting the learners' perspective; knowledge centred, building on validated knowledge; assessment centred, applying formative assessments; and community centred, learning is considered a joint effort in which students learn from and with each other. Given these conditions, the ubiquitous use of personal and shared technologies should be taken into account in mobile learning research (Sharples et al., 2007). In a meta-analysis of mobile learning research papers, Wu et al. (2012), like Crompton (2013a), conclude that research in the field of mobile learning follows two main research directions. One direction is rather deterministic: evaluating the effectiveness of mobile learning. The second direction is a design approach: researching the development of mobile learning systems. Wu et al. (2012) further conclude that:

- Surveys and experiments are the most-frequently used methods.
- The research outcomes are mostly being positive.
- Mobile phones and personal digital assistants (PDA) are the most common technologies used for mobile learning.
- Higher education is the most researched area, followed by elementary school.
- Mobile learning is most common in the applied sciences, followed by the humanities and the formal sciences.
- The most cited articles in the field are in the categories of mobile learning system design and effectiveness of use.

The evidence produced within the mobile learning field should be treated with caution as it is a new, rapidly growing field. Most studies have been undertaken in a short time, over short periods, with small groups and on novel technology (Sharples, 2013). The focus has seldom been on classroom practice (Sung, Chang, & Liu, 2016), and studies on upper-secondary school are scarce (Wu et al., 2012). Arrigo et al. (2012) issue a slight critique of the mobile learning research field and suggest that if mobile learning researchers provided more valid evidence on benefits from the use of mobile technologies in education, and if policy makers let mobile learning influence policy, the two groups could understand each other better.

2.5.1 APPROACHES TO LEARNING SPARKED BY TECHNOLOGY

Mobile learning is an approach to learning that builds on the use of mobile technology. The first seed of what would later enable the development of mobile learning was planted in 1972, when Alan Kay drew up the visionary concept of a portable, integrated personal computer: the Dynabook. The Dynabook prototype featured many of the properties later integrated into laptops, tablets and mobile phones. The first mobile phone was developed in 1973 but was not available commercially until 1983 (Crompton, 2013a). Indeed, the dynamic Dynabook had more in common with the mobile phones of today than did the functionalities of the first mobile phones. Only later, however, when digitisation made it possible to make technologies smaller and more diverse did the mobile learning design and research field start to take shape. In the 1990s, new technologies, such as the Palm Pilot and other PDAs, emerged. However, to the broader public, the most profound technological development was the spread of the mobile phone.

The potential of using these new technologies for learning was soon recognised (Sharples, 2000; Quinn, 2000; Soloway et al., 2001). Sharples (2000) identifies a parallel between the development of technology and the discourse of learning. At the same time that the technologies being developed were becoming increasingly personalised, mobile and networked, the discourse of learning was becoming more learner centred and

increasingly viewed learning as a collaborative activity. The combination of these circumstances could support lifelong learning by personalising the learning practices in which the learner used connected technology to interact with other learners and resources (Sharples, 2000).

During this era, a critique of the common model of investing in technology in schools emerged as it became increasingly clear that investments in computer labs and advanced technology for teaching did not mean that the technology was actually used as infrastructure for learning in education (see e.g. Cuban, 2001). If technology were to be used in schools, then it had to be built on more workable solutions. Computer labs were not the solution. Learning in computer labs was an exception rather than the routine of school practice. A suggested alternative was to equip students with handheld devices which could be used for learning activities whenever needed (Soloway et al., 2001). The mobile phone was one such handheld technology, and using mobile technology for learning purposes was soon termed m-learning, or mobile learning (Quinn, 2000).

Initially, mobile learning was regarded as an extension of e-learning. For example, Keegan (2002) defines it as 'the provision of learning on wireless and mobile devices' (p. 43). Consequently, in the early 21st century, mobile learning projects used e-learning methods for assessments, making evident the shortcomings of mobile technology compared to more advanced desktop computers (Traxler, 2011). Despite these technological shortcomings, it was obvious that the mobile technologies added value to the learning process that desktop computers and e-learning solutions could not. While e-learning can be defined as 'all forms of electronic supported learning' (Tavangarian, Leypold, Nölting, Röser, & Voigt, 2004, p. 274), mobile learning has to be networked, making the learner mobile (Crompton, 2013b).

However, it has been argued that the use of mobile technology for learning in the classroom should more accurately be called e-learning or handheld e-learning. The formal classroom is by nature not mobile, so it has been suggested to be a setting where mobile learning cannot occur. Hence, research on the use of mobile phones in classroom settings, therefore, cannot be mobile learning research (Wishart, 2015). Mifsud (2014), though, contends that school is part of the society that mobile technologies have pervaded and made mobile, so mobile learning practices in the

classroom should be considered. Moreover, if mobile learning is learning that occurs anywhere and at any time, then the formal classroom cannot be an exception. When recognising the situated nature of learning, the school is not considered to be a single unit, but rather, every classroom is a unique setting. This view is actually quite natural as different teachers teach different subjects differently in each and every classroom. Thus, each classroom is a new context with its own social and cultural history. The reluctance to recognise the use of mobile technology in classroom practice as mobile learning (see e.g. Wishart, 2015) then actually is an indication of the tensions in classroom practices as from the mobile learning perspective, mobile learning is contested by the classroom.

Malcolm, Hodkinson, and Colley (2003) state that formal and informal learning are not easily separated, and formal elements often appear in informal learning and vice versa. Indeed, the classroom is generally regarded as a formal learning space, and a mobile learner may be spontaneously curious in the classroom or come across situations relevant to formal schoolwork outside the classroom.

2.5.2 MOBILE LEARNING AND FORMAL EDUCATION

This thesis builds on the argument that students bring their mobile phones to school regardless of regulations, so there is a need for more knowledge on how students use the devices in school and how their use is perceived by teachers and other stakeholders. However, the formal classroom is a learning setting with a heightened sense of norms and expected silence (Ling, 2004) dependent on physical, temporal and contextual presences. Mobile technologies, in contrast, are typically regarded as noisy devices as they mediate conversation and communication (Sharples, 2002). Mobile learning involves learning and interaction with contexts beyond the physical setting (Mifsud, 2014). Mobile technologies and mobile learning thus challenge the fixed context of school and the classroom (Kukulska-Hulme et al., 2009). As schools struggle to deal with the distractions from students' mobile devices, mobile learning has not been accepted as an approach to achieve excellence in school.

Successful formal learning with mobile technology has been difficult to achieve. Formal education generally does not involve mobile learning

projects. However, the conditions to achieve success in a mobile learning project and the conditions to integrate mobile learning practices into formal education are not essentially different (Alrasheedi & Capretz, 2013). Naismith and Corlett (2006) identify five conditions essential for mobile learning projects to succeed: connectivity; availability of technology; institutional support, such as professional staff development and maintenance of the technological infrastructure; integration with curricular activities; and ownership as students must feel that the technology they use is their own property, or they can treat it as their property. Few classrooms and schools in the early 21st century met these conditions.

However, since 2006, at least in Swedish upper-secondary classrooms, students have had access to personal, connected mobile technology through their mobile phones (Statens-medieråd, 2015). Institutional support and integration with curricular activities are, as the research in this thesis indicates, conditions that have been more difficult to meet in both Swedish and international contexts. School systems in Europe have not embraced mobile phone technology. In fact, research shows that bans on the use of mobile phones in the classroom are common not only in Sweden but also throughout Europe and the US (Kukulska-Hulme et al., 2009; Pachler et al., 2013; Thomas & Muñoz, 2016). Despite bans, students still bring their mobile phones to school (Charles, 2012; European Commission, 2013; Kukulska-Hulme et al., 2009) and use them for example to text during lessons (Katz et al., 2014).

Previous research shows that in formal educational settings, mobile phones can be distracting (Berry & Westfall, 2015; Mifsud, 2014) and are used for cheating (Campbell, 2006; Thomas, O'Bannon, & Britt, 2014), texting during class (Katz et al., 2014), cyberbullying, sexting (Thomas & Muñoz, 2016), accessing social media, gaming (Lindberg, Olofsson, & Fransson, 2016) and online posting (Mifsud, 2014). It has also been suggested that in school environments with no established structured use of mobile phones, banning them has positive impacts on low-achieving students' educational results (Beland & Murphy, 2015). However, in the traditional school environment, there have always been distracting interruptions of the schoolwork, and the present distractions, even if mediated by mobile phones, are as traditional as the organisation of schools (Hassoun, 2014). Moreover, Pachler et al. (2013) argue that fear of distractions

mediated by mobile phones represents a conflict between, on one hand, the traditional view of school organisation in which the teacher delivers knowledge specified in the curriculum and on the other hand, the notion of school as an arena for an individualised learning practice in which the teacher is more of a guide.

Despite the disturbances from the mobile phone, research suggests that schools and classrooms are settings where personal mobile technologies, such as mobile phones, can be supportive of practice (Campbell, 2006; Peck et al., 2015; Sharples, 2013). Mobile technologies in the classroom can support, for example, the utilisation of response systems (Vavoula et al., 2005); interaction between lecturers and students through texting (Cobb, Heaney, Corcoran, & Henderson-Begg, 2010); the implementation of BYOD (Adhikari et al., 2012; Cochrane et al., 2014; Selwyn & Bulfin, 2016; Thomas & Muñoz, 2016); students' motivation for schoolwork (Tessier, 2013); the authenticity of education (Roberson & Hagelik, 2012); flipping of classrooms (Fulton, 2012; Herreid & Schiller, 2013); access to online materials (Thomas et al., 2014); and collaborative learning (Kukulska-Hulme, 2010).

Research also shows that faculty and students seem to perceive the disruptions from mobile phones in the learning environment differently. From a socio-material perspective, Mifsud (2014) suggests that teachers are challenged by mobile learning as knowledge is distributed beyond the classroom, the space where teachers can exert authority. Students do not always favour using or permitting mobile phones in school but are generally less hostile towards mobile phones in school than faculty in higher education (Baker, Lusk, & Neuhauser, 2012; Berry & Westfall, 2015), and upper-secondary school (Lindberg et al., 2016). Gao, Yan, Wei, Liang, and Mo (2017) find that parents, teachers and students in K-12 schools do not agree on why mobile phones are used in school, whether they should be banned, if mobile phone policies are effective and how to improve them, but they also find that parents, teachers and student do agree that mobile phones should not be permitted during classes and exams and that mobile phone policies should be more firmly enforced to be effective. However, Charles (2012) finds that in practice, high school teachers and students negotiate the enforcement of mobile phone policy. Olin-Scheller and Tanner (2015) report that secondary students and teachers do not always find

mobile phones to be distracting as they are mostly used between assignments. In the research, there is a persistent suggestion that instead of banning mobile phones, students and teachers need to learn how to use them to support the school practice (e.g. Humble-Thaden, 2012; Keengwe, Schnellert, & Jonas, 2012; Maguth, 2013).

Similar to the first solution for the 1:1 investments suggested by Grönlund (2014), that schools should use the same technology that pervades society, it is proposed that denying students access to the technology they are used to have access to might even cause them harm, such as frustration and disengagement in schoolwork. It might also challenge the relevance of school education in a digital society (Hope, 2013). Students have become accustomed to using digital technology to solve problems, and a general restriction on access to technology during class might make them use their personal technology as a substitute. Consequently, as Peck et al. (2015) suggest, teachers who intentionally do not include ICT in teaching likely might encounter increased use of mobile phones by students during class.

2.6 SUMMARY

The Swedish government has a history of recognising technological developments and encouraging their influence on formal education. The comparison of policy makers' approach to computers and tablets and their approach to mobile phones in school then is somewhat startling. Computers have been distributed in large numbers while mobile phones have been more or less banned. However, mobile learning research presents many examples demonstrating that mobile technology, such as the mobile phone, can be used in learning. Mobile learning research generally has been experimental rather than focused on the use of mobile phones in day-to-day school practice. However, there are exceptions that show that mobile phones can be both beneficial and harmful to ordinary school practice. The next section presents the theoretical perspective that this thesis applies to the study of the mobile phone in everyday school practice.

CHAPTER 3

THEORETICAL FRAMING

In this chapter, the theoretical frameworks used for the analyses in the studies are presented. This thesis elaborates the renegotiations of the boundaries between social practices generated by the presence of students' mobile phones in school. This problem area originates from the controversies brought to surface by the entrance of a new mobile technology into school practice. Studying this problem area calls for analytical tools that recognise the social interplay between social actors, context and technology.

To frame the complexity of the tensions surrounding the mobile phone in school, the four studies compiled in this thesis do not rely on the same methods and analytical tools. Ott (2014) draws from historical materialism to understand the emergence of the tensions surrounding the mobile phone in school. Ott et al. (2014) rely on boundary crossing to frame these tensions, while Ott et al. (2017a) and Ott et al. (2017b) understand them as tensions related to the development of infrastructure for learning. What brings these different analytical approaches together is that they can be understood from a sociocultural perspective

which understands human activity as mediated by tools with a social and cultural history. A mobile phone in the hands of a student is not merely an assembled piece of plastic, metal and glass. It rather is an artefact that mediates social, organisational and work-related activities. In the analysis presented in this cover essay, the notion of infrastructure (Star & Ruhleder, 1996) is the most influential analytical tool. Infrastructure is understood as an ecology of mediating artefacts and human and social resources (Guribye, 2015).

3.1 MEDIATING TOOLS

Sociocultural analyses study human activity as the interaction between a subject and its context. A foundational premise is that almost all human interactions with reality are mediated by artefacts (Säljö, 2000), which are both tools (objects) and signs (e.g. language, text and counting systems) modified by humans (Vygotskij, 1978). Artefacts can also be labelled mediational means and cultural tools which an agent uses when interacting with a context (Wertsch, 1997). During the process of reaching the current state, artefacts have been loaded with cultural values and built from the knowledge accumulated over their history. Artefacts, therefore, are at the same time material and ideal on a conceptual level (Cole, 1996). Artefacts are ideal as their design is the result of a process guided by the purpose of a potential use. During that design process, they are inscribed with and shaped by their intellectual, social and cultural history. When used in an activity, an *ideal* artefact becomes a tool. Artefacts survive through their use as tools for mediating activity (Cole, 1998). For example, a mobile phone is foremost designed for corporate, retail or recreational communication (Traxler, 2007), but when used for learning in formal education, it also becomes a tool for schoolwork.

Altogether, human activity cannot be understood in isolation from artefacts and their inscribed social and cultural values (Säljö, 2000). Agents and tools gain their meaning through their interactions mediated by cultural tools and mediational means that both enable and constrain human activity. Trying to understand human agents and artefacts separately, therefore, can lead to a potentially blinding reductionism (Wertsch, 1997). Humans are the main actors, but all human activity is mediated through

artefacts, so they must be considered to understand and to analyse human activity (Guribye, 2005).

Different models acknowledge the interplay of artefacts and human activity. Cultural–historical activity theory (CHAT) is prominent, and socio-materiality and historical materialism also acknowledge that social factors influence the material (technology), and vice versa (Leonardi & Barley, 2008). The mobile phone is one of many technological artefacts present in schools. Understanding mobile phones in school practice from a sociocultural perspective entails acknowledging that mobile phones carry with them a history and cultural values (Pachler et al., 2013). When the technology is used in school practice, the history and the social and cultural values of both the artefacts and the practice are highly significant to analysis.

In CHAT, as conceptualised by Engeström (1987), an activity is influenced by systemic factors beyond the local level of the activity. The systemic factors of the activity comprise immaterial cultural factors (rules, community and division of labour). Engeström's (1987) model of CHAT has been used in mobile learning (see e.g. Sharples et al., 2007; Liaw, Hatala, & Huang, 2010), but the application of the model is beyond the scope of this thesis. However, the model opens sociocultural theory to historical materialism's system of production. The systemic factors of CHAT framed in rules, community and division of labour share similarities with the relations of production and the superstructure. Applied to society, the relations of production and the superstructure constitute the economic structure of society that guides the forces of production (Tosh, 2000). The forces of production then can be understood as the activity suggested by Vygotskij (1978) and Leontiev (1978), as 'the tip of the iceberg', in the words of Engeström (2001, p. 134). The subject can then be understood as the labour, the object of the activity as the production, and the tools mediating the activity as the infrastructure and other resources.

The systemic factors also open up the activity beyond local tool use. They thus share analytical similarities with infrastructure as conceptualised by Star and Ruhleder (1996). Indeed, infrastructure is truly socio-material as it is constituted by tools and social resources that rely on routines, acceptance and organisation to constitute a functioning infrastructure (Edwards, 2003). Similar to the struggle for control over the forces of pro-

duction, the socio-material position suggests that the conflicts that follow the spread of mobile technologies are tensions between established and new classroom practices emerging from the use of mobile technologies (Mifsud, 2014).

3.2 TENSIONS

In this thesis, the conflicts surrounding the mobile phone in school are understood as tensions. Tensions can occur when two seemingly opposing forces meet (Kee & Browning, 2010), brought together, for example, by infrastructure which connects users who hold with different opinions (Edwards, Jackson, Bowker, & Knobel, 2007) or by social practices and communities of practice which are not bodies of homogenous participants (Handley, Sturdy, Fincham, & Clark, 2006). Fairhurst (2001) suggests that certain dialectical tensions are the 'copresence of two relational forces that are interdependent, but mutually negating' (p. 420). The study of dialectical tensions reveals connections between the forces (Kee & Browning, 2010).

In a study on the development of infrastructure, Ribes and Finholt (2009) draw on the participants' formulations of problems they have encountered in practice and analytically understand tensions as the participants' conflicting goals, purposes and motivations. To Star and Ruhleder (1996), tensions reflect the ambiguity of local variations in organisational change and infrastructure development. Edwards et al. (2007) suggest that tensions can be both barriers and resources for the development of infrastructure. If engaged constructively, tensions can serve as indicators of areas that need to be addressed to enhance the sustainability and fit of infrastructure. In this thesis, tensions are understood as conflicts emanating from a lack of common coherence between two or more stakeholders brought together by a joint concern. The tensions documented in the empirical material can be understood as expressions of a developing infrastructure and as intrinsic elements of boundary crossing and boundary objects (Grossen, Zittoun, & Ros, 2012) and challenges to school practice.

3.3 BOUNDARIES, BOUNDARY OBJECTS AND BOUNDARY WORK

Students' use of mobile phones brings external elements and practices of the social world outside school into school, and vice versa (Ott et al., 2014). This has turned out to be problematic as human activities gain their meaning from the context in which they are situated. Learning activities are no exceptions (Lave & Wenger, 1991). Being a student in school entails participating in a social practice that brings people together physically and conceptually. This situated nature of this activity can be framed within different boundaries. In this thesis, school practice is understood as participation in a social practice that builds on an installed base of infrastructure to support learning (Guribye & Lindström, 2009).

The concept of social worlds suggested by Phelan et al. (1991) provides another way to frame the situated nature of students' activities. Yet another description is communities of practice held together by mutual engagement, joint enterprises and a shared repertoire. From this perspective, learning is increased participation in practice (Wenger, 1998). Communities of practice, social worlds (Phelan et al., 1991) and infrastructure (Star, 2010) are all sites[2] that have boundaries not completely sealed off from the neighbouring entities that they border.

> Often, a boundary implies something like edge or periphery, as in the boundary of a state or a tumor. Here, however, it is used to mean a shared space, where exactly that sense of here and there are confounded. (Star, 2010, pp. 602-603)

A boundary is a border and a border zone. The boundary is both a dividing and a uniting site. People, students, teachers and other stakeholders do not participate in one site at a time but in multiple sites simultaneously (Ludvigsen, Lund, Rasmussen, & Säljö, 2010). As stakeholders act in and

2 In this thesis, a site is not merely a geographical place, but the notion of sites is understood to describe units with boundaries. In this thesis, these units are infrastructure, social worlds and communities of practices (cf. Star & Griesemer, 1989).

move between various sites at different times, the sites overlap in shared spaces that the stakeholders manifest by their actions (Star, 2010). When students and teachers move between sites inside and outside school, they cross boundaries at all times, and students' use of mobile phones confounds the different social worlds in which they participate and the norms and practices of those social worlds.

Akkerman and Bakker (2011) discuss boundaries as conceptual boundaries rooted in a conceptualisation of sites held together by social and cultural factors. A boundary then is a noticeable change in the social and cultural conditions.

> A boundary can be seen as a sociocultural difference leading to discontinuity in action or interaction. Boundaries simultaneously suggest a sameness and continuity in the sense that within discontinuity two or more sites are relevant to one another in a particular way. (Akkerman & Bakker, 2011, p. 133)

Boundary spaces arise when two or more sites interact through boundary objects or through boundary crossing by humans, such as brokers (Wenger, 1998).

Star and Griesemer (1989) state that boundary objects can be understood as objects which reside in overlapping social worlds. They can be both abstract and material, and they 'have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable' (Star & Griesemer, 1989, p. 393). Star (2010) further elaborates on the concept of boundary objects and states that they enable functioning cooperation between groups despite a lack of consensus. On those occasions, the boundary objects are poorly structured between the social worlds or communities of practice, but locally in various groups, the boundary objects are maintained and even reinforced. On the ideal level, the material/organisational structure of boundary objects always has a certain scale/granularity reaching beyond the local. With these properties, boundary objects can constitute organic infrastructures that allow people from different sites to cross into the boundary space and perform work together (Star, 2010).

This interpretive flexibility is a foundational understanding when studying the mobile phone in school from the different approaches used in this thesis. Boundary objects, according to Star's (2010) definition, can have similarities with mediational means (Wertsch, 1997) or mediational artefacts (Säljö, 2000). Following Star (2010), boundary objects can be either material or symbolic objects which people act towards and with. As with mediational means and artefacts, objects gain their meaning through actions. From the sociocultural perspective, the history of the objects imbues them with various cultural values in different contexts. The mobile phone can be understood as one such boundary object. Outside school, the mobile phone is important in students' social activities; in school, the mobile phone is not as appreciated (Ott et al., 2014). This is a sociocultural difference (Akkerman & Bakker, 2011) and what Star and Griesemer (1989) describe as interpretive flexibility.

The activity of boundary crossing manifests the boundaries through person's interaction across different sites (Suchman, 1994). Adolescents, for example, actively cross the boundaries among the social worlds of family, peers and school (Phelan et al., 1991). In fact, school is a practice of boundary crossing. If, for example, education is considered to be either the development of identity or training in skills and knowledge, education implicitly involves crossing boundaries. Education as the development of identity seeks to transform the learner from what the learner is into something the learner is not yet. Education as the development of skills and knowledge has the ultimate goal to enable the learner to be able to participate and collaborate across boundaries between different sites (Akkerman & Bakker, 2011). Walker and Nocon (2007) argue that there is a specific competence of being able to function well in multiple contexts – a *boundary-crossing competence*:

> In advancing our notion of boundary-crossing competence, we define competence as the ability, within a given context, to (a) understand and negotiate the meanings, through the use of material and symbolic artifacts, and (b) to understand and negotiate the meanings, through engagement with others, of the practices of a group and of the roles of individuals therein. (Walker & Nocon, 2007, p. 180)

Brokers with a boundary-crossing competence have the ability to work in two ways. They work inwards, introducing repertoires from outside their local site, and they also work outwards, as they scaffold the movements of artefacts and people across the boundaries of their local sites (Walker & Nocon, 2007). Boundary objects are significant interfaces for communities of practice (and social worlds) to connect to a functioning infrastructure (Bowker & Star, 2000). The next section of this chapter elaborates the concept of infrastructure as it is used in this thesis to analyse the tensions in school surrounding the presence and use of mobile phones.

3.4 INFRASTRUCTURE

In this thesis, the mobile phone is studied in relation to the social and technological arrangements that constitute the infrastructure for learning in school. Studying the infrastructure for learning in school rather than the artefact itself means that the analysis focuses on the interconnectedness of artefacts and their embeddedness with tools in the social, institutional and technological arrangements (Guribye, 2015). The notion of infrastructure permits contextualising the tensions emanating from the presence of the mobile phone in school settings in relation to the elements in and beyond the setting which have impacts on the practice. When disruptions in functioning occur, the infrastructure is most visible.

In this section, the notion of infrastructure is discussed. First, infrastructure as a general concept with both social and material properties is presented. This notion is then narrowed down to the infrastructures for learning and the infrastructural elements on which classroom practice relies.

3.4.1 INFRASTRUCTURE—SOME GENERAL PROPERTIES OF THE CONCEPT

When analysing school practice through the notion of infrastructure, some fundamental concepts of infrastructure need to be established. Star and Ruhleder (1996), in an influential article on infrastructure, suggest a framework of eight key dimensions of infrastructure:

- *Embeddedness.* Infrastructure is 'sunk' into, inside of, other structures, social arrangements and technologies;
- *Transparency.* Infrastructure is transparent to use, in the sense that it does not have to be reinvented each time or assembled for each task, but invisibly supports those tasks;
- *Reach or scope.* This may be either spatial or temporal—infrastructure has reach beyond a single event or one-site practice;
- *Learned as part of membership.* The taken-for-grantedness of artifacts and organizational arrangements is a sine qua non of membership in a community of practice […]. Strangers and outsiders encounter infrastructure as a target object to be learned about. New participants acquire a naturalized familiarity with its objects as they become members;
- *Links with conventions of practice.* Infrastructure both shapes and is shaped by the conventions of a community of practice, e.g. the ways that cycles of day–night work are affected by and affect electrical power rates and needs. […]
- *Embodiment of standards.* Modified by scope and often by conflicting conventions, infrastructure takes on transparency by plugging into other infrastructures and tools in a standardized fashion.
- *Buildt on an installed base.* Infrastructure does not grow de novo; it wrestles with the 'inertia of the installed base' and inherits strengths and limitations from that base. […]
- *Becomes visible upon breakdown.* The normally invisible quality of working infrastructure becomes visible when it breaks: the server is down, the bridge washes out, there is a power blackout. Even when there are back-up mechanisms or procedures, their existence further highlights the now-visible infrastructure. (Star & Ruhleder, 1996, pp. 5–6)

Definitions of infrastructure using these eight dimensions have proven to be very robust (Guribye, 2015; Pipek & Wulf, 2009). Applying these dimensions to understand infrastructure is valid in both social and material approaches.

To shift from the understanding of infrastructure as merely material and to emphasise the social aspects of infrastructure, the concept

of information infrastructure has been introduced (Hanseth & Lundberg, 2001; Star & Bowker, 2006; Star & Ruhleder, 1996). Information infrastructure is a *heterogeneous*, inseparable mixture of technology, non-technological, human and social elements characterised by the same eight infrastructural dimensions suggested by Star and Ruhleder (1996). Information infrastructure is constituted by the resources *shared in a community*. These different components are integrated through *standardised* interfaces. Information infrastructures have *no strict limits for inclusion*, function or purpose and, in that sense, are *open*. These characteristics have relevance to the social aspects of participation in socio-technical networks (Hanseth & Lundberg, 2001). This view of infrastructure can open up a quite descriptive, general perspective on infrastructure.

However, to capture the tensions among different stakeholders and sites in relation to school, the descriptive understanding of infrastructure can also be accompanied by an inside perspective based on the actors' positions in the infrastructure. This approach utilises the understanding of infrastructure as layered and relational. That infrastructure is layered implies that, for example, a task carried out by one person could be part of another person's enabling infrastructure. In that sense, infrastructures build on each other. The relational aspect of infrastructure implies that the focal object for some users is the infrastructure for others (Kling, 1993). An example presented in the literature is plumbing. For most people, plumbing is part of the infrastructure providing water and drainage services to their houses, but for the plumber, the plumbing is the very object (Star, 1999; Star & Ruhleder, 1996). An example from school can be language, often the mother tongue (in Sweden, it is Swedish). The language is a tool used to mediate learning activities in all subjects; therefore, it is infrastructure. However, to the teacher teaching Swedish, the language is also the object taught.

Central to the concept of infrastructure is not the question of *what* is infrastructure but rather *when* and *to whom* artefacts are infrastructure (Monteiro, Pollock, Hanseth, & Williams, 2013). In the example of Swedish as a language and as a school subject, the matter of what or when infrastructure rests on the subjects' position in relation to the language. This indicates the importance of an analytical approach to infrastructure (Star & Ruhleder, 1996). The relational (*when* and *what*) property of infra-

structure implies that infrastructure is something that is happening. Infrastructure becomes visible as part of a struggle to integrate technology into the routines of an established infrastructure. When the tensions between that local practice and the larger system of technologies are resolved, then infrastructure happens.

> An *infrastructure occurs when the tension between the local and global is resolved.* That is, an infrastructure occurs when local practices are afforded by a larger-scale technology, which can then be used in a natural, ready-to-hand fashion. It becomes transparent as local variations are folded into organizational changes, and becomes an unambiguous home—for somebody. This is not a physical location nor a permanent one, but a working relation. (Star & Ruhleder, 1996, p. 6)

With these characteristics, infrastructure becomes something without clear boundaries or pre-definition (Star & Ruhleder, 1996). It is relative to working conditions (Star & Bowker, 2006).

3.4.2 INFRASTRUCTURE FOR LEARNING

For the study of the mobile phone in the school's infrastructure for learning, the elements constituting the infrastructure need to be framed. Hanseth and Lundberg (2001) suggest that infrastructure that supports human activities is divided in two cooperating infrastructures: a universal service infrastructure which enables the functioning of things in general and work-oriented infrastructures which support more specific practices. Work oriented infrastructure is dedicated to the performance of specific, complex tasks.

Drawing on the concept of information infrastructure and the notion of universal service infrastructure and work oriented infrastructures (Hanseth & Lundberg, 2001), Guribye and Lindström (2009) describe the analytic approach to infrastructure for learning:

> an infrastructure for learning is a set of resources and arrangements—social, institutional, technical—that are designed to and/or assigned to support a learning practice. (Guribye & Lindström, 2009, p. 112)

This definition could describe schools as they are today. Guribye (2005) uses teaching at universities to illustrate what elements constitute infrastructure for learning, for example, auditoriums and the equipment installed in them, calendars, time-tables, janitors, administrative staff, learning management systems (LMS), the Internet, books and curricula.

Infrastructure for learning is not static but emerges through practice. It is potentially endless, and what is included depends on what is under study. For example, an analysis of infrastructure for learning might not include the same resources when the same group of students studies different subjects. What is of interest is what the conceptual and the abstract units of the infrastructure entail in formal school beyond the conceptual level, as well as the development of the units of the infrastructure and their relational properties as mediating artefacts in practice.

For analytical purposes, infrastructure for learning shares the same characteristics as general infrastructure. Infrastructure for learning is layered and is connected to and sometimes difficult to separate from general infrastructure (Guribye, 2005). This thesis studies school, so the concept of *infrastructure for learning* frames what material and social features of school are analysed. Infrastructure for learning is not only constituted by designed digital technology but also has social layers and it is not restricted by the boundaries of the classroom (Guribye, 2015). Its layers stretch from the policymaking level of school via society into classrooms. There, teachers and students practice teaching and learning at what can be considered, if not the endpoint, at least a way point in the many layers of infrastructure for learning manifested through formal education.

School practice is guided by a mixture of formal rules and regulations and informal norms and values (Selwyn & Bulfin, 2016). Tool use in classroom practice depends not only on technological features but also on the social arrangements in the school environment. In the classroom environment, the technological infrastructure is intertwined with the social infrastructure that enables interactions among collaborators using computers. Bielaczyc (2001) suggests that the social infrastructure has three levels:

- A cultural level concerning the culture of the classroom in which the technology exists and the norms and philosophy among students and teachers

- An activity level concerned with the classroom practice and how activities that do not involve connected technology complement online activities
- A tool level concerned with the use and modification of the tools in the environment

This conceptualisation of social infrastructure, however, has been criticised by Lipponen (2002) for emphasising technology too much as a necessity for social infrastructure. Instead, social infrastructure can be considered to be a precondition of technological infrastructure as the social and technology infrastructure co-evolve (Lipponen, 2002). With less focus on technology and more focus on the situated nature of the social infrastructure, Bielaczyc (2006) suggests further developing the *social infrastructure framework* as tool for the design and the evaluation of the integration of technology-based tools into classroom practice. The social infrastructure framework emeges as four dimensions:

- *The cultural beliefs dimension*. This dimension encompasses perceptions and conceptualisations of knowledge, technology and the environment (e.g. the classroom). It also includes the social identities of both teachers and students.
- *The practices dimension*. This dimension concerns how the work in the classroom is organised, for example, grouping of students and ways of engaging in activities by students and teachers.
- *The socio-techno-spatial relations dimension*. This dimension consists of how physical and virtual spaces are organised. One example is the distribution of technology student–teacher–machine–physical–space.
- *The interaction with the outside world dimension*. This dimension refers to students' interactions with external people and materials and to factors affecting students' motivations and the authenticity of the school assignments.

This framework is less technology centred than the three levels of social infrastructure (Bielaczyc, 2001) but has still been criticised by Guribye (2015) for not acknowledging the relational and layered properties of

infrastructure, for predefining social and technical factors in possibly misleading ways and for putting a local focus on infrastructure, when classroom practice is only one aspect of infrastructure.

In this thesis, the recognition that school practice depends on factors beyond the classroom is the foundation for the application of the notion of infrastructure to analytically frame and merge the different approaches to studying the tensions surrounding the mobile phone in school used in the various studies in this thesis. Although infrastructure reaches beyond the classroom, the *social infrastructure framework* still suggests social aspects in the classroom that need to be considered when studying the tensions surrounding mobile phones in school practice.

3.4.3 DEVELOPMENT OF INFRASTRUCTURE

Technology changes and infrastructures evolve. Even if technologies appear fixed and complete, and people treat them accordingly, they never are (Orlikowski, 2000). Since the parts that constitute infrastructure change, infrastructure also evolves. However, the introduction of a new technology does not necessarily lead to the development of a functioning infrastructure (Guribye & Lindström, 2009). Such development is constrained by the *sine qua non*; changes must align with the overall infrastructure, and the changed service or function must remain compatible with other parts of the infrastructure (Hanseth & Lundberg, 2001). If the introduction of a new technology is not carefully thought through, it holds the potential to cause the breakdown of a fully functioning infrastructure.

> […] it can be quite 'futile' to dump a technology into an existing practice without any clear idea of how this particular tool will play a role in the ecology of existing communicative practices and infrastructural arrangements. A thorough understanding of key elements of an existing practice can be key in such cases. (Guribye, 2005, p. 193)

This awareness of the risk to seemingly functioning practices is the starting point for an exploration of the tensions surrounding mobile phones in formal education from the infrastructural perspective. A difference, though, is that mobile phones have not been 'dumped' into school prac-

tice from above but have entered from below. However, the growth of infrastructure can only be partly designed (Pipek & Wulf, 2009). The actual use of technology in practice is often the result of users' improvisation (Orlikowski, 1996). Having a clear idea of the role the introduced tool will play, therefore, does not mean that a top-down, tightly controlled introduction will go smoothly. Infrastructure grows through the use of technology in practice, so having a clear idea (as suggested by Guribye, 2005) rather consists of awareness of and a plan for how the dumped technology will inevitably impact existing practice. It is a critical condition that new IT becomes infrastructure in relation to the technical and social arrangements in the environment within which it is supposed to function (Star & Ruhleder, 1996).

The development of infrastructure is a slow process both shaped by and shaping use in practice (Bygholm & Nyvang, 2009). Pipek and Wulf (2009) use the term *infrastructuring* to describe the work of developing infrastructure beyond the professional designer's intention. Infrastructuring is the development of infrastructure through use. Infrastructuring is similar to the development of *technology-in-practice* as suggested by Orlikowski (2000), where structure is enacted through recurrent use. Recurrent use, though, does not simply happen; it takes effort, and the change, development and maintenance of infrastructure require work: 'it is easy enough to develop a potentially revolutionary technology; it is extremely hard to implement it' (Star & Bowker, 2006, p. 156). Learning how to use a technology or a social resource in practice is one example of the infrastructuring process and can be addressed on different levels.

Bygholm and Nyvang (2009) draw from Bateson's (2000) notion of communication as hierarchal and propose three levels of learning to explain the challenges in the implementation of new IT. The first level addresses the challenges of learning to operate the tool. The second level is similar to the concept of learning as participation (Lave & Wenger, 1991) and concerns learning to operate the tool in an appropriate manner in practice. On the third level of learning are the challenges of understanding the fundamental values and the concepts of practice. Unlike the second and third levels, the challenges on the first level can be solved without negotiation. Bygholm and Nyvang (2009) state that if the aim is to achieve infrastructure as suggested by Star and Ruhleder (1996), then

the challenges on the second and third levels cannot be solved by the individual (unlike the challenges on the first level) but must be handled by collectives engaging in negotiations. When designing for learning after the introduction of new ICT, therefore, the designer must acknowledge that negotiations of the values and goals of the organisation will occur (Bygholm & Nyvang, 2009).

The growth of infrastructure is a material and a social process. It is a process in which the different layers, both social and material, need to communicate. To function, that communication needs standardisation or metadata that contextualises the communication; otherwise, the information from lower layers is incomprehensible (Star & Bowker, 2006). Orlikowski, Yates, Okamura, and Fujimoto (1995) call this process *meta-structuring* and refer to the development of technology and social structures instead of infrastructure, but its meaning has obvious similarities. In particular, technology use is heavily dependent on how the user perceives the technology. Regarding the uptake of technology in education, teachers' beliefs, as suggested by Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur and Sendurur (2012), are another way to frame a similar process. If teachers perceive digital technologies as useful tools in school, the teachers, as social resources in the infrastructure, find it easier to interact with the technological layers.

Users' perceptions are shaped by the descriptions and the reputations of the technology as it is portrayed by all sorts of more or less powerful stakeholders (Orlikowski et al., 1995). In the classroom, the stakeholders directly engaged in negotiating the use of mobile phones are students and teachers (Charles, 2012). In negotiations of the role of technology in an information infrastructure, closure can be reached when the facts or artefacts that have caused controversy have been stabilised by consensus on their role in the infrastructure. However, the negotiations that may lead to closure can have connotations of a social power struggle. For example, closure by redefinition is reached when one social group's destabilised artefact is stabilised by a more powerful social group's definition of it (Misa, 1992). The closure process can also be understood in terms of naturalisation. Technology is the focal point of the naturalisation process, but once integrated into the infrastructure, the technology fades into the back and becomes a supporting resource (Guribye & Lindström, 2009).

3.5 SUMMARY

The infrastructural perspective depends on a sociocultural foundation. Infrastructure for learning comprises the social and institutional resources and arrangements assigned to support learning at a specific site. These artefacts and resources have a history and are loaded with cultural values. In using infrastructure as an analytical tool, the social and material properties of infrastructure and school are acknowledged. The interconnectedness of artefacts and their embeddedness, along with tools, in the social, institutional, and technological arrangements, are scrutinised. However, infrastructure can be difficult to identify and to separate. Infrastructure is relational and layered. When moving between the different layers of infrastructure, individuals engage in a boundary-crossing practice, for example, moving between the universal service infrastructure and the work oriented infrastructure for learning in school.

With these properties, infrastructure is never static. Infrastructure is an ecology of resources manifested through practice and grows and changes with the development of its parts. The growth of infrastructure involves much struggling, learning and negotiating before a new technology or resource is naturalised into the infrastructure. Studying the mobile phone in upper-secondary school with the notion of infrastructure entails paying attention to what material and social resources are in play in practice and how they are perceived and used by various stakeholders.

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGICAL CONSIDERATIONS

This thesis builds on four separate studies based on different empirical materials, research methods and theoretical perspectives in the analysis (see Table 1). This chapter explains how the empirical material was generated and how the four studies construct the research design of the cover essay.

Table 1. Overview of the articles in the thesis

	Methods	**Empirical material**	**Theoretical concepts**
Article 1 (Ott, 2014)	Textual analysis Statistical analysis	113 newspaper articles, 1996–2012	Historical materialism
Article 2 (Ott et al., 2014)	Questionnaire with multiple-choice and open-ended questions	28 survey responses	Boundary crossing
Article 3 (Ott et al., 2017a)	Questionnaire	276 survey responses	Beliefs, infrastructure
Article 4 (Ott et al., 2017b)	Questionnaire with multiple-choice and open-ended questions Focus group interviews	206 questionnaire responses 19 participants in four focus groups	Infrastructure

4.1 RESEARCH DESIGN

When studying the tensions surrounding mobile phones and school practice from the socio-cultural perspective and the notion of infrastructure, practice becomes dependent on what is happening beyond the local setting (Star, 1999; Star & Ruhleder, 1996). Social, technological and non-technological arrangements are elements in the infrastructure of learning (Guribye, 2005). The research design of this thesis acknowledges the social aspects of infrastructure, and the dependence of the use of mobile phones in school practice on many actors. As in every other social practice, the work of students and teachers in the classroom does not take place in an environment isolated from influences from other positions than those in the classroom.

> Use of technology is strongly influenced by users' understandings of the properties and functionality of a technology, and these are strongly influenced by the images, descriptions, rhetorics, ideologies and demonstrations presented by intermediaries such as vendors, journalists, consultants, champions, trainers, managers, and 'power' users. (Orlikowski et al., 1995, as cited in Orlikowski, 2000, p. 409)

Many stakeholders are involved in schooling, including teachers, parents, learners, policy makers and industry (Parsons, 2017). It is difficult to identify exactly who exerts influence on certain occasions. For example, school practice is guided formally by policy makers through legislation and curriculum (Cuban, 2013) and informally by teachers' beliefs (Ertmer, 2005), public-debate rhetoric (Karlsohn, 2009), technological development (Tallvid, 2015), parental involvement in children's education (Hoover-Dempsey & Sandler, 1997), the visions of head teachers (Hermans, Tondeur, van Braak, & Valcke, 2008) and sometimes a mixture of formally and informally grounded negotiations between teachers and students (Charles, 2012).

From the sociocultural perspective, artefacts through their history carry social and cultural values (Cole, 1996). To understand the role of IT in practice, the idea of inscribed cultural values can lead to a deterministic view of how structures are manifested through the technology. Orlikowski (2000) suggests applying a practice lens to study the emer-

gence of new structures through use of technology rather than structures fixed in the design of technology. Use of technology embodies existing structures and contributes to the development of new structures. The structures in a practice do not decide human actions with technology; rather, human practice with technology constitutes structures.

> Together, the notions of emergent structure and enactment afford a practice-based extension to existing structurational models of technology. This practice lens posits humans as constituting structures in their recurrent use of technology. Through their regularized engagement with a particular technology (and some of its inscribed properties) in particular ways in particular conditions, users repeatedly enact a set of rules and resources which structures their ongoing interactions with that technology. (Orlikowski, 2000, p. 407)

Technology use does not only shape practice. It is a reciprocal interaction, in which where the features of a technology gain meaning as they are used in a practice that the designer cannot plan or decide. The practice lens, therefore, studies what people actually do with technology (Orlikowski, 2000). Rasmussen and Ludvigsen (2009) insist on broadening the perspectives on ICT-triggered changes in education. Accordingly, drawing on the notion of infrastructure, the analysis in this thesis is based on the application of three different practice lenses: a lens on public and political perceptions of mobile phones in school settings (Ott, 2014); a lens on teachers' perceptions of technology and permission for mobile phone use during their lessons (Ott et al., 2017a); and finally, a lens on students' perceptions and management of mobile phones in school (Ott et al., 2014; Ott et al., 2017b).

Influential researchers within the mobile learning research field (e.g. Kukulska-Hulme et al., 2009) acknowledge the need for mobile learning research to spread across academic disciplines.

> European researchers in mobile learning and ubiquitous learning will be keen to tackle the new challenges arising from learner activity across multiple virtual and physical contexts, spanning formal and informal learning. This will require a combination of technical, pedagogical and sociological expertise to be able to make sense of and give some directions to emerging forms of mobile and blended learning. (Kukulska-Hulme et al., 2009, p. 30)

Responding to this appeal and the call by Rasmussen and Ludvigsen (2009) to broaden the perspectives on ICT-triggered changes in education, this thesis compares and synthesises the foci highlighted in the four studies to explain the tensions surrounding the mobile phone in school and to contribute to the understanding of the role of the mobile phone in schools' infrastructure for learning.

4.2 METHODOLOGICAL CONSIDERATIONS

As a pragmatic perspective, the ecological infrastructural perspective is sensitive and open to the interconnections between artefacts and the relations among social, organisational and technological arrangements (Guribye, 2015). This thesis builds on methodological pluralism. In the studies, both qualitative (newspaper articles and documented focus group interviews) and quantitative (questionnaires and counts of newspaper articles) empirical materials are analysed. Statistical analysis, textual analysis and content analysis are all methodologies applied to scrutinise the issue of mobile phones in schools' infrastructure for learning. Thus, the empirical data are constituted by complimentary qualitative and quantitative data.

This thesis, therefore, builds on the pragmatic, mixed-methods approach and renounces the doctrinaire application of one specific methodology (Cohen, Manion, & Morrison, 2013). Pragmatism can have some negative connotations, particularly being sloppy (Denscombe, 2008). However, with the selection of a mixed-methods approach, pragmatism is a consequence of the research design and not a desired means to make the research more convenient. The mixed-methods approach is selected to increase the openness and inclusiveness of the research scope. To come to grasps with the multi-layered ecology of schools' infrastructure for learning, it is desired to remain sensitive to multiple ways of knowing and perceiving a phenomenon, as suggested by Greene (2005). The foundational concept of the research design in this thesis is to merge different actors' classifications of mobile phones in school. Johnson and Onwuegbuzie (2004) define mixed-method research as:

> The class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study. (p. 17)

According to this definition, all but one study (paper 3) presented in this compilation thesis is mixed-methods research. Paper 3 is the only purely quantitative study. However, in this thesis, the results from paper 3 are considered in the analysis on equal terms as the results from papers 1, 2, and 4, incorporating paper 3 into the overall mixed-methods analysis. The strength of the mixed-methods research most relevant to the analysis of the use of mobile phones in school from the infrastructural perspective is the ability for word pictures and narratives to add meaning to numbers, and vice versa (Johnson & Onwuegbuzie, 2004). For example, in Ott (2014), both the publication counts and the content of newspaper articles are used to draw conclusions. When merging qualitative data with quantitative data, the generalisability of the results can be increased (Johnson & Onwuegbuzie, 2004). For example, in Ott et al. (2017b), the results from a survey indicate that the sampled focus groups are representative of the whole population.

Like other methodological approaches, mixed-methods research has practical and theoretical weaknesses. The mixed-methods researcher cannot be as specialised in a single method as a researcher using only one method, which opens up room for critiques by purist researchers (Johnson & Onwuegbuzie, 2004). However, infrastructure is a heterogenic phenomenon with several layers and levels worth studying. Star (1999) argues that infrastructure can be studied with different methods, but the exploration must be guided by acknowledgement that actions gain their meaning from the context in which they are performed. This thesis studies the mobile phone in the context of school from the perspectives of different stakeholders with different roles within this context. The research design is guided by the understanding that the mixture of qualitative and quantitative research can produce more complete knowledge to inform theory and practice, as suggested by Johnson and Onwuegbuzie (2004).

4.3 A PRACTICE LENS ON THE PUBLIC DEBATE

In this thesis, the influential external factors are captured through a practice lens on the public debate on mobile phones in school. The practice lens on the public debate is enacted through a historical materialist analysis of the debate on mobile phones in Swedish print media. Historical

materialism draws from a Marxist (Marx, 1970) worldview and understands society as divided into three layers. At the bottom are the *forces of production*, which refers to tools, technologies and labour. On the top is the *superstructure*, which refers to legal and political institutions and their supporting ideologies. Between the forces of production and the superstructure lie the *relations of production*, which include the division of labour and organisation manifested in legal documents and policy (Tosh, 2000). Politically affiliated newspapers, including those in the empirical material, are part of the superstructure (Gramsci, 1999). Newspapers belong to the information infrastructure of society and are inscribed with information about the society in which they are produced (Star, 1999). Using the practice lens reveals the structures enacted through the on-going debate. The rhetoric of journalists is among the factors that influence how technology is perceived and ultimately structured in practice (Orlikowski, 2000)

Newspapers are one arena in which the public debate is mediated. Hence, the historical materials used are remnants of that debate. The newspaper articles do not describe what actually happened in school or in politics, but as remnants, they provide a reliable source for studying the debate (Tosh, 2000). During the time period studied, social media and alternative media channels emerged; therefore, concerns can be raised about changes in the impact of traditional newspaper articles on public opinion during the study period.

The newspaper articles included in the empirical material were gathered through two searches in the online database Mediearkivet. The first search used the keywords 'mobile phones' and 'the school', and the second search used the keywords 'mobiles' and 'the school'. The total of articles found was 113. See Ott (2014) for a more detailed description of the selection of the sampled newspaper articles.

For the analysis, the articles are positioned chronologically based on publication date and read and analysed for rhetoric and context. Finally, the explicit content and the implicit messages in the articles are interpreted. This historical overview serves as a benchmark for the analysis of the results from the other studies in this thesis. Ott (2014) does not explicitly rely on the concept of infrastructure. However, the historical materialist perspective sheds light on the relations between structure and activity and contains infrastructural elements (Friedman, 1974). The focus, though, is not on the construction of infrastructure but on the struggle for power over infrastructure and its outcomes.

4.4 TEACHERS' PRACTICE THROUGH THE LENS

The practice lens on the teachers' practice was examined using an online questionnaire. By itself, this cross-sectional snapshot provides rather limited knowledge of a phenomenon. However, when the responses are put in the wider context of other data sources, they can provide valuable information (Cohen et al., 2013; Shadish, Cook, & Campbell, 2002). For this analysis, the survey results on teachers' permission for mobile phone and technology use in their practice are merged with the results from the other three studies on the broader infrastructural perspective of learning in school.

The survey was distributed to teachers in a Swedish municipality with four municipal upper-secondary schools as part of a larger evaluation of the municipal investment in ICT in upper-secondary schools (Player-Koro, Karlsson, Ott, Tallvid, & Lindström, 2014). The survey was administered to the teachers during a professional development day. The survey included multiple questions concerned primarily not with teachers' use of mobile phones but with their experiences of the municipality's ICT investment. The questions addressed the teachers' demographic backgrounds, use of technology in their practice, attitude towards mobile phones and ICT in relation to their practice and finally approval of mobile phones in their practice. The teachers' responses indicate how they view themselves in relation to students' use of mobile phones during lessons.

4.5 STUDENTS' PRACTICE THROUGH THE LENS

A practice lens on students is applied in two separate studies (Ott et al., 2014, and Ott et al., 2017b). First, Ott et al. (2014) distributed a cross-sectional questionnaire to students in an upper-secondary school class (N=28) in a school targeted in the teacher survey presented in Player-Koro et al. (2014). The students responded to questions regarding their use of mobile phones for schoolwork at home and their perceptions of mobile phones as tools for learning in school.

The second study (Ott et al., 2017b) involved both a survey and focus group interviews. The survey served three purposes. First, it guided the selection of the sample for the focus group interviews representative

of the population. Second, the survey provided data that informed the moderators' (the researchers) preparation of the focus group interviews. Third, the survey provided data for the analysis. The population studied in Ott et al. (2017b) were students at two upper-secondary schools in Sweden. Focus group interviews with students were chosen to gain more profound, contextualised, and explanatory insights into their perceptions and management of their mobile phones in school. The researchers were not direct participants in the practice under scrutiny, so the focus group interviews, as described by Vibeck (2000), opened up discussions, arguments and interpretations not known by the researchers.

4.6 ETHICAL CONSIDERATIONS

The research in this thesis is not considered to uncover information about students or teachers that requires review by the ethical review board. However, the research was performed giving consideration to common ethical issues regarding the use of sources, respondents and participants in research. In Ott (2014), which did not include any interviews or surveys, source criticism was used to validate the historical sources regarding authenticity, dependence, closeness in time and bias (Kjeldstadli, Persson, Åmark, & Torhell, 1998).

In line with the ethical guidelines of the Swedish research council (Vetenskapsrådet, 2011), the teachers and the students who responded to surveys in Ott et al. (2014), Ott et al. (2017b) and Ott et al. (2017a) could have chosen not to respond. The students' participation in the focus groups in Ott et al. (2017b) was voluntary. The students were all older than 15 years and could give written informed consent to participate without their parents' involvement. No documentation was done with video or photos, and all audio documentation and notes taken during the focus group interviews were stored on a secure server. All the schools and the classes were made unidentifiable, and all the participants were anonymised in the presentation of the results.

4.7 SUMMARY

The four studies in this thesis use mixed methods to study the tensions surrounding mobile phones in school practice: textual analysis of historical remnants (newspaper articles), three surveys (one with teachers, two with students) and focus groups with students. For the synthesis in this cover essay, the results are considered to be observations through practice lenses looking at how the tensions surrounding mobile phones in school emerge in the practice of the stakeholders scrutinised.

CHAPTER 5

SUMMARY OF THE EMPIRICAL STUDIES

In this chapter, the empirical findings from the four studies are summarised. The studies are presented in two published articles (Ott, 2014; Ott et al., 2017b) one conference paper (Ott et al., 2014), and one article still in the manuscript stage (Ott et al., 2017a).

5.1 A HISTORICAL MATERIALIST ANALYSIS OF THE SWEDISH PRINT MEDIA DEBATE ON MOBILE PHONES IN SCHOOL SETTINGS

This study explores the popular debate on mobile phones in two major Swedish newspapers. As historical sources, newspaper articles are often biased and do not provide reliable accounts of historical events. Instead, newspaper articles reflect what journalists, governments and editors judge to be suitable for public consumption. Consequently, newspaper articles do not reflect what really happened. However, as historical remnants, they

provide valid and valuable sources. Even if articles do not uniformly advocate a political agenda, they do reflect the hegemonic social and political perspectives at the time of publication. Thus, they provide valid chronological accounts of common and accepted opinions (Tosh, 2000). The study aim is to understand the societal forces important to how mobile learning is approached in school. Scrutinising the public debate serves as a means to capture societal and political forces' views on mobile phones in school. Drawing on articles about mobile phones in school published since 1996, the study provides a longitudinal overview of the debate on mobile phones in school.

The results show that banning mobile phones from school was a recurring topic in the debate from 1998 to 2012. Often, the mobile phone was grouped with other objects under a recurring formulation: mobile phones and other disturbing objects, including caps, snuff, fireworks and narcotics. Most articles support bans on mobile devices. There are two peaks in the publication dates, first in 2002 (24 articles) during an election to parliament and second in 2006 (12 articles) and 2007 (25 articles). In 2006, there was an election to parliament, and in 2007, relevant legislation was enhanced, providing clearer legal grounds for teachers to confiscate disturbing objects in the school environment. After 2007, the debate was less intense.

The dates of publication indicate that banning mobile phones became a topic driven by political interests. Some politicians stressed the connection between banning mobile phones from school and successful electoral outcomes. The actors in the debate, with few exceptions, supported bans. Most of the people heard in the debate were policy makers, primarily Jan Björklund, the Liberal minister of education (2007–2014) who appears in more than 50% of the articles. He is also the most energetic proponent of a ban. Except for two younger members of the Moderate party, all the other politicians agreed that mobile phones should be banned from school, but nuances separated these political pundits. Some regarded banning mobile phones from schools as the crucial solution, the silver bullet, to improve education. Other politicians, still supporters of the ban, identified other issues as more important to improving Swedish education better.

However, occasionally dissenting opinions were raised. One head teacher claimed that mobile phones were becoming essential tools for students in education. Nevertheless, this position was a rare exception in the debate. On the whole, it was considered to be self-evident that mobile phones should not to be used. The harsh pro-ban argument was at times suggested to be symbolic, even dangerous, stealing focus from truly significant educational issues. Although the majority of people in the debate were policy makers, the media reported the opinions of other people, including students and regular citizens who were interviewed. One person interviewed was a man who had been spontaneously attacked by a group of adolescents and was disabled for life by his injuries. When the newspaper reporter asked him what needed to be done to end the kind of assaults like that against him, he responded that schools must ban mobile phones, caps and snuff. However, the few voices opposing the bans contended that confiscation of students' mobile phones was a violation of private ownership.

The study conclusion is that from a historical materialist perspective, the debate is an expression of the superstructure's struggle to control the changing forces of production. This struggle to control mobile phones in school has been rather unsuccessful as the debate has remained more or less unchanged over the time period studied.

5.2 STUDENTS' USE OF MOBILE PHONES FOR SCHOOLWORK

The second article studies the relation between upper-secondary students' use of mobile phones for schoolwork at home and their perceptions of mobile phones as a suitable tool for schoolwork in school. Haglind (2013) finds that students use mobile phones to carry out schoolwork at home but do not believe that it would be a good idea to let them use their mobile phones for schoolwork in school. The present study is designed to explore this contradiction. The study builds on a questionnaire distributed to 28 students in the first year of upper-secondary school as part of a larger evaluation of municipalities' investment in the ICT infrastructure in their upper-secondary schools.

In the analysis, mobile phones are considered to be boundary objects as defined by Star (2010). Mobile phones belong to the social world of home but are brought into school. Despite the reluctance of both students and teachers, students sometimes use mobile phones for schoolwork. At the same time, schoolwork is brought into the social world of homes mediated by mobile phones. Mobile phones open up a boundary space confounding the social worlds of home and school, though it remains clear that there are two separate social worlds with different social norms and practices.

All the students in the sample had access to mobile phones, and 26 had access to smartphones. All the students brought their mobile phones to school every day. When asked to rate themselves as beginner, normal, habitual or expert mobile-phone users, 12 students consider themselves to be expert users, 12 habitual users, and 4 normal users. The results show that all the students used their mobile phones for schoolwork at home to some extent, including 93% weekly. The most common uses of mobile phones at home were collaborating with classmates through social media and texting, looking at pictures, browsing the Internet for information, doing calculations and translating words. There were no statistically significant correlations between user types and uses, except that the students who ranked themselves as expert users more frequently accessed the LMS than other groups of students.

In school, the students considered mobile phones to be a tool that could be used for many purposes, except for revising lesson notes, watching materials produced by the teacher and writing school assignments. The tasks for which the students stated that they used their mobile phones at home were among those tasks for which the students judged mobile phones to be most suitable in school. The tasks for which the students wanted to use mobile phones were doing calculations, searching for information, translating words, communicating, keeping a calendar and taking pictures. The results also indicated that the students identified the devices' limitations in relation to schoolwork. Although they used mobile phones for schoolwork at home, 13 of the 28 students stated that they did not know what to use their mobile phones for in school or did not want to use them in school. The cited reasons included privacy concerns, size limita-

tions compared to computers and unwillingness to share their Internet connection.

The students who ranked themselves as expert users were more sceptical towards using mobile phones in school than the habitual and normal users. The obstacles these students identified to using mobile phones in school were size, cheating, teachers and distractions. The students in the study seemed to regard the computer as a more suitable tool for schoolwork and the mobile phone as a complement to it. The students accepted mobile phones in use for schoolwork at home but not as a tool for schoolwork in school.

5.3 UNINTENTIONAL INTEGRATION OF TECHNOLOGY—TEACHERS' ATTITUDE AND PERMISSION OF MOBILE PHONES AS LEARNING TOOLS IN THE CLASSROOM

This article studies upper-secondary teachers' implicit permission for students' use of mobile phones during lessons. Teachers' permission is suggested to describe the dynamic decision work as teachers negotiate mobile phone usage in classroom without formal bans on mobile phones. The study builds on a survey distributed to 337 upper-secondary teachers at four upper-secondary schools in a midsized Swedish city. The survey received responses from 276 (82%) of the teachers. The questionnaire was part of a larger evaluation of municipalities' investment in ICT (Player-Koro et al., 2014). The questionnaire inquired whether the teachers gave students permission to use their mobile phones and specific mobile-phone functions during class. Due to attrition during the responding to the questionnaire, 210 teachers (63%) responded to these questions. The responses regarding permission for mobile phone usage were tested for correlations with demographical background variables, teachers' beliefs regarding ICT and education in general and teachers' use of ICT in teaching.

The teachers were asked about their permission for general use of mobile phones during lessons and their permission for specific uses. In the results, 72% of the teachers generally permitted students to use mobile phones during class but often to a rather low extent. The teach-

ers' responses regarding permission for specific uses indicated that some uses were permitted more frequently than others. Accessing social media and gaming were generally not permitted. According to the results, the teachers rarely used social media or gaming in their teaching, so these uses were not really related to schoolwork. Uses related to schoolwork, such as accessing the LMS and searching for information, were permitted more frequently than general use of mobile phones.

The statistical analysis showed no significant correlations between teachers' permission for mobile phone usage and teachers' sex, age or the school at which they taught. However, the subjects the teachers taught influenced the permission they gave. Social sciences and language teachers generally gave more permission than science, math and vocational teachers. Permission was supported by teachers who believed that the learning environment benefits from the use of ICT and social media. Teachers who considered ICT in school to be problematic were generally less permissive.

Overall, the study results indicate that the teachers were quite permissive of mobile phone usage in teaching. They did generally not actively work to integrate mobile phones into their teaching but did permit uses that could support student learning. Despite a general lack of intention on the part of the teachers, integration of mobile phones into school practice was underway.

5.4 "IT MUST NOT DISTURB, IT'S AS SIMPLE AS THAT": STUDENTS' VOICES ON MOBILE PHONES IN THE INFRASTRUCTURE FOR LEARNING IN SWEDISH UPPER SECONDARY SCHOOL

The aim of this study is to contribute to understanding of how students' use of mobile phones in schools influences their school practice. This study explores *how Swedish upper secondary students reason about the usage of mobile phones in school.* The focus is on students' perceptions of current school policy regarding mobile phone use and students' descriptions of how they organise their use of mobile phones in school. Research has shown that despite legislation, students bring their mobile phones to

school (Ott et al., 2014; Thomas & Muñoz, 2016; Wastiau et al., 2013). This study builds on four focus group interviews with 19 upper secondary students in two schools in western Sweden.

The results of the focus group study show that the students brought their mobile phones to school. In relation to the BYOD approaches suggested as the future of school practice, the study results indicate that students already brought their own devices to school and negotiated them into the infrastructure for learning. The students' narratives show that they used their mobile phones in many activities, social (e.g. keeping in touch with friends and family), practical (e.g. organising their day, using calendars and searching for information) and leisure (e.g. gaming and listening to music). They kept their mobile phones within reach day and night. However, the students did not believe that adults fully understood that their mobile phones were not toys but essential resources in their universal service infrastructure.

In school, the students found that the use of mobile phones presented both benefits and drawbacks, and the students acknowledged that the many uses and situations that they described contained potentially beneficial and distracting elements. Most students believed that their education benefited from mobile phones, particularly by providing them with access to the Internet and online information. However, they saw notifications and access to social media as potentially disturbing and distracting. The students stated that mobile phones could cause disturbances in the classroom but also contributed to calming the classroom environment. Some students had started to develop uses that supported their knowledge acquisition by accessing external expertise through the Internet. Some students found mobile phones to be less suitable for schoolwork than computers but still used mobile phones as a complementary technology when the computers provided by the schools were not sufficient. Other students reported that their teachers perceived mobile phones as disturbing even when used for schoolwork. At the same time, teachers sometimes encouraged them to take photos of the white board.

The schools had no formal policy on mobile phones, but the students recognised the implicit rule that mobile phones should not disrupt the classroom. The students did not favour banning or confiscating mobile

phones but supported guidelines and suggested that younger generations could be trained in how to appropriately use mobile phones. Students were expected to respect teachers, and there was a discussion of whether respectful behaviour could involve mobile phones. The bottom line of the students' reasoning was that the use of mobile phones was individual students' responsibility as long as it did not distract anyone else, but there was no consensus among the students on what constituted appropriate use. Mobile phones as devices did not seem to be the foremost threat to the work environment in the classroom. The students were more distracted when their peers whispered or interacted over mobile phones than when individual peers silently used mobile phones.

To summarise, the upper secondary students' narratives of their management of their mobile phones in school indicate that they were aware of the difficulties and concerned about the impact of mobile phones on education. They also struggled with the implicit negotiations regarding integrating mobile phones into the infrastructure for learning in school.

CHAPTER 6

DISCUSSION

The documented presence of mobile phones in school is the result of a bottom-up adoption of technology that has occurred beyond the control of schools. From the mobile learning perspective, the present situation in schools appears to be opportune. Previous barriers to technology access have been removed, and the mobile phone is ubiquitous (Traxler & Kukulska-Hulme, 2015). The classroom has evolved into a place where interaction with digital mobile devices takes place. Moreover, schools generally provide students with laptops and tablets (Perselli, 2014).

However, the use of mobile phones in schools has turned out to be a contested activity. Grönlund (2014) argues that penetration of technologies throughout society has provided a clear, valid motivation for schools to invest in 1:1 projects. This argument does not seem to apply for how schools invest in the use of mobile phones. In school, the visions of mobile learning researchers are challenged by a social practice with well-established traditions on how to engage in everyday activities. In this test, the mobile phone has become the topic of intense debate about school practice. Even to some mobile learning researchers (e.g. Wishart, 2015), mobile learning appears to be difficult to merge with school practice.

6.1. EXPLORING THE TENSIONS SURROUNDING MOBILE PHONES IN SCHOOL PRACTICE

The aim of the thesis is to critically scrutinise the mobile phone as a tool for learning in upper-secondary school and to contribute to the mobile learning research field by addressing the use of mobile phones in school from the perspectives of the relevant stakeholders. The research design aims to expand the understanding of the complexity and the development of the tensions surrounding mobile phones in school. This chapter first draws from the four studies exploring the tensions surrounding mobile phones to address the research questions. Then, the challenges to school practice posed by the mobile phone are discussed, and finally, the tensions surrounding the mobile phone are explored using the notion of infrastructure.

6.1.1 TENSIONS REFLECTED IN THE PUBLIC DEBATE

The mobile phone first appeared in relation to learning and education in the historical remnants of the public debate in 1996 during the heyday of the Swedish IT boom. The mobile phone presents an interesting example from the IT boom. In its first appearance in the debate, the mobile phone was portrayed as an almost futuristic tool that supported extramural learning, but as the debate unfolded, the descriptions of the mobile phone in school changed, with few exceptions, portraying it as a nuisance. The cultural value the mobile phone represented in relation to school was as a disturbing object. To some extent, the shift in the debate reflected how the debate about ICT in school became more nuanced after the bursting of the IT bubble (Karlsohn, 2009). In the debate afterward, the mobile phone was generally not seen as a tool in school practice but a challenge to school practice. Areas in which the mobile phone was described as a challenge were the work environment of the classroom, the authority and the professionalism of teachers, the concept of what school is, the pedagogy in education, older generations' influence over younger generations, schools' monopoly on the distribution of infrastructure for learning and the implementation of the curriculum.

Students talking and texting on phones challenged the expected quiet of the classroom learning environment (cf. Campbell, 2006). The students did not engage in the classroom activities in way that the teachers expected. New functions and technologies (e.g. MP3 players and integrated cameras) mediated unfamiliar behaviour, and students' new conduct was understood as disturbing to school practice. In the public debate, this situation was manifested in reactionary rhetoric. The mobile phone was often portrayed as a disturbing object and grouped in various constellations with other disturbing objects, such as caps, chewing gums, snuff, sticks, videogames, knifes, narcotics and fireworks.

Moreover, students' changed behaviour was described as causing tensions in the school hierarchy. For example, in 2011, Minister of Health and Social Affairs Göran Hägglund argued for confiscation of mobile phones during class as a means for teachers to exert their authority (Ott, 2014). Like Hägglund, most advocates of this viewpoint in the public debate were politicians. Parsons (2017) classifies politicians as top-down policymakers and teachers as both influenced by and influencing policy. In this debate, teachers did not hold a strong position as policy influencers and did not describe the tensions surrounding mobile phones as especially severe. However, teachers were not present in the debate to the same extent as policymakers. In that sense, it was not just the mobile phone that caused tensions and challenged teachers' authority. Policymakers also challenged teachers' authority by pushing an agenda regarding mobile phones in school that did not draw on what teachers requested. In fact, in the debate, teachers claimed that the ban on mobile phones in school undermined their professionalism, and other stakeholders even questioned teachers' ability to enforce policy in a legally secure way.

In one article, a student questioned the connection between effective learning and mobile phone bans and whether granting more disciplinary tools to teachers really facilitated learning. The student was familiar with the social conventions of the classroom and stated that it was rude to not pay attention to the teacher. However, some students' rudeness should not be blamed on the mobile phone, which this student argued that she sometimes used as a tool for schoolwork. This opinion offered by a student is one example that indicates how the mobile phone mediates challenges from the younger generation to the older generation and represents

diverse cultural values to adolescents and adults (cf. Pachler et al., 2013). For example, when politicians stated that it was self-evident that mobile phones should not be used in school, they expressed the perception the mobile phone should not be part of school practice. Nevertheless, mobile phones became essential to students as they mediated participation in social activities and sometimes schoolwork.

Students were clearly participants in school practice and brought their mobile phones to school, so the mobile phone caused tensions between the policy makers and the recipients of the policy. Such tensions included, for example, the challenges that personal ownership of technology posed to schools' monopoly on the distribution of technology and the assignment of the infrastructure for learning. This issue, therefore, challenged the whole decision-making process of the school system. The top-down policy makers did not choose the technology. Moreover, the mobile phone mediated new uses and new influences on education that schools had not decided and did not have the means to control. Related to what school was and what school was not was the issue of influence from the society and the social worlds outside the school. In the debate, this influence from the outside of school was portrayed as an issue of disruption from the outside mediated by the mobile phone. However, the mobile phone also put the school in contact with the world outside the protected classroom, so the presence of mobile phones in schools also challenged curriculum implementation, demanding that schools be attentive to the complex reality with high flows of information and levels of change (Skolverket, 2013).

6.1.2 REGULATING THE TENSIONS THROUGH PERMISSION

In 2007, with the goal to reduce the tensions surrounding mobile phones in school, the Swedish government gave teachers legal authority to confiscate objects disturbing or threatening the security of education. The legislation does not require teachers to confiscate mobile phones but allows teachers to judge what uses threaten education and justify confiscation of mobile phones and which uses are not threatening and thus can be permitted. Moreover, as Berry and Westfall (2015) state, teachers with this legislative authority must also judge what is most disruptive to lessons: the disturbing use or the enforcement of the rule. Indeed, the study of teach-

ers' permission for usage of mobile phones in school (Ott et al., 2017a) reveals that in practice restricting and permitting cannot be understood as polarised issues. It, therefore, becomes of interest to explore teachers' attitudes and beliefs regarding what is threatening or disturbing to education as these are factors that influence teachers' decision work over which uses to ban and permit.

The design of school tasks is a collective process. When teachers assign students tasks based on predefined curriculum-based content, they continue others' work. In the continuous evolution of tasks, students become intrinsic participants in the design process as they elaborate their ideas of what tasks they are supposed to carry out and what methods and tools they should deploy (e.g. Tallvid, 2015). In classrooms where students are equipped with laptops, such task development often involves the use of ICT (Tallvid, Lundin, & Lindström, 2012). Regarding mobile phones, teachers occasionally have to restrict or permit development of the original task. When mobile phones are present in everyday practice, teachers give permission through not seeking to restrict their use. Students, through involving their mobile devices in practical ways, suggest that they are relevant tools in practice. In that process, the efforts of some teachers are more powerful than those of others.

Teachers do not give equal permission to all mobile phone uses. Social media and other uses deemed to be personal or disturbing of classroom practice are rarely permitted. Teachers' permission for mobile phone usage is more frequent when the usage is connected to pedagogically relevant tasks. In other words, the teachers permit the students to use what are perceived as suitable technologies for the subject and task at hand. The understanding of usefulness is important in the integration of new technologies into school practice.

Although teachers express little intention to use mobile phones in school, Ott et al. (2017a) and previous research (e.g. Charles, 2012) indicate that mobile phones have been integrated into the infrastructure for learning in many classrooms. The integration of mobile phones into school practice has been supported with fewer resources than legislative efforts to ban mobile phones. In the classrooms where the mobile phone has become part of practice, this has happened without a plan, explicit organisational goals, institutional support, training or policy incentives for

teachers or the students to do so. Without guidelines or training, teachers' intentions and ideas on the suitable use of mobile phones are highly dependent on broader attitudes towards the digitalisation of education.

The empirical material shows that teachers who believe that education benefits from use of ICT are more permissive of mobile phone usage than other teachers. Based on Richardson's (1996) finding that practice more strongly influence teachers' beliefs than beliefs do practice, it can be suggested that if mobile phones were permitted and actively utilised during lessons, more positive beliefs would follow. In practice, students' utilisation of mobile phones for schoolwork would then reinforce teachers' belief that mobile phones and technology can be used for schoolwork. It would make teachers constantly reconsider the role and usefulness of the new technology and relate it to their concept of good educational practice. Consequently, the smaller group of teachers who view the use of mobile phones and technology less positively is left out of the process that could make them reconsider the use of mobile phones. To them, the legislation could provide incentive to not engage with mobile phones in the classroom.

6.1.3 STUDENTS' PERCEPTIONS OF THE TENSIONS

Students' perceptions of the mobile phone as a tool in school practice are both stated explicitly and implicitly reflected in their descriptions of how to use mobile phones in schoolwork. According to the studies in this thesis (Ott et al., 2014; Ott et al., 2017b), students perceive the mobile phone both as a useful tool for schoolwork and as a distraction which can cause tensions in the classroom. Moreover, the studies show that students perceive the mobile phone as an underused tool, and even students who do not personally wish to use it in school still acknowledge its potential as a tool for schoolwork. Other students state that they are not entirely sure what to do with the mobile phone but believe that they would have more use for it with training in how to use it as a tool for schoolwork.

The main reasons that the students identify as reasons for not using mobile phones more in school are the technological limitations of the mobile phone (e.g. screen size and lack of a keyboard); the distractions that the mobile phone mediates (e.g. gaming, texting and using social

media); teachers' perceptions of mobile phones as inappropriate for schoolwork; and the design of school assignment (e.g. writing essays and taking tests) unsuitable for mobile phones. When computers are available and easy accessible, they are often preferred over mobile phones, partly for their larger screen size. The use of mobile phones in education and during lessons could also be perceived as an expression of disrespect for the teacher, as also reported in the public debate.

Although the students do not entirely agree, they are familiar with the description of the mobile phone as a disturbing object. They are aware of that use of mobile phones can be disturbing and distracting, but as long as the distraction and disturbance does not affect anyone other than the user, they generally consider it to be the individual user's responsibility to engage in their education.

However, many students find mobile phones to be useful tools in schoolwork in school (e.g. taking notes, coordinating schoolwork with their peers and searching for information on the Internet), even if only to check the time. At home, many students use their mobile phones as tools for schoolwork. Mobile phones support, for example, doing calculations, translating words, looking at pictures and searching the Internet for information. Mobile phones also enable collaboration, and the students use their mobile phones to text with their peers. The students also access social media through their mobile phones and use it to coordinate schoolwork with groups from classes or specific subject groups.

To the students, the mobile phone has become a tool that mediates schoolwork at home and in school, as well as non-school related, off-task usage in school. In use, the different functions of the mobile phone and even the mobile phone itself can be understood as boundary objects between sites (social worlds, infrastructure or communities of practice) inside and outside schools. Students who manage to use mobile phones in school practice can be understood as having developed a boundary-crossing competence and ability to act as brokers, as suggested by Walker and Nocon (2007). The students balance reciprocal influences from different sites and, independent of teachers, engage in learning activities facilitated by mobile phones.

6.2 MOBILE PHONES IN SCHOOLS

The first research question deals with the tensions surrounding the mobile phone as reflected in the public debate, the second research question concerns teachers' permission for mobile phone usage, and the third research question addresses students' perceptions of mobile phones in school practice. In this section, the responses to the research questions are discussed as profound challenges to practice in upper-secondary school. The four studies elaborate the complexity of the cultural value of the artefact itself. However, not only the mobile phone but also school has a cultural and social history. The studies reflect not only stakeholders' perceptions of mobile phones in school practice but also stakeholders' perceptions of how school practice is situated culturally and historically.

6.2.1 MOBILE PHONES AND THE CONVENTIONS OF SCHOOL PRACTICE

School practice relies both on the formal curriculum and on the conventions of a hidden curriculum of school culture built over generations (Wren, 1999). Despite the many features of the mobile phone that *can* and occasionally *are* used for schoolwork, such as mobility and connectivity, the mobile phone has not proven to fit very well with the regulated classroom that historically is the centre of formal school practice.

School practice is shaped by examinations that represent the meaning and purpose of school (Bernstein 2000). For example, the individualistic, formalised grading system is traditionally manifested in practice by the established methods of measuring what students can recall and by letting students solve assignments in isolation (cf. Hattie, 2012). The connectivity of the mobile phone puts it in direct opposition to the conditions of such practices (Sharples, 2002). In previous research, even students acknowledge that one difficulty associated with the use of mobile phones in school is the opportunities to cheat in the schoolwork (e.g. Campbell 2006; Thomas & Muñoz, 2016). Connectivity, though, is not enough to explain this conflict as laptops are also connected. Moreover, in the studies in this thesis, cheating is foremost identified as an issue in the public debate by adults. The students view cheating only as an obstacle to the use

of mobile phones in school (Ott et al., 2014). The students surveyed by Ott et al. (2017b) do not mention cheating as an obstacle for using mobile phones in school.

There could be several reasons for this inconsistency in the students' responses in the two studies and previous research. First, previous studies often used surveys more actively offering students response alternatives related to cheating and sexting than the free-text questions in the empirical data in this thesis. Second, the sampled students are not the same but the question regarding hindrances to using mobile phones is the same in the two studies in this thesis (Ott et al., 2014; Ott et al., 2017b). That students could cheat with the support of mobile phones is not mentioned as a hindrance to mobile phone usage by the students in the Ott et al., (2017b). Third, the survey in Ott et. al., (2017b) is not anonymous, which could motivate the students to not mention cheating. Fourth, the students in Ott et al., (2017b) know well what is and is not acceptable use of mobile phones. Nevertheless, the data suggest that the students in Ott et al. (2017b) see the use of the mobile phone as more linked to the conventions of school practice in which cheating is not an accepted conduct. Overall, the idea that cheating is a key issue is mostly expressed by the older generation of teachers, policy makers and researchers.

However, even if it is accepted that connectivity is what makes the mobile phone a tool for cheating, mobile phones not connected to the Internet have features, such as calculators, that the data show support students. However, mobile phones are students' private property and not distributed by schools, so it is difficult and ethically questionable for teachers to demand access to the contents of students' personal mobile phones to ensure that they are not connected to the Internet. That mobile phones are students' personal property and not technology distributed by schools also relates to the issue of equality (Parsons & Adhikari, 2016).

6.2.2 MOBILE PHONES AND EQUAL EDUCATION

In suggestions for national strategies for education, Skolverket (2016c) refers to the Swedish school law (SFS. 2010:800) and states that in education, schools cannot rely on the use of students' personal technology, including mobile phones, without supplying the technology to all students.

When schools invest in technology, they do it on the premise that all students within a specific boundary, such as the same class or school, must be given equal conditions to perform schoolwork.

That access is a matter of equality has become a truism not firmly anchored in research (e.g. Katz et al., 2014), which indicates that students across socio-economic status have access to mobile phones. However, there are issues of equality involved. Although access to technology is often considered as an advantage, Selwyn (2004) argues that equality is a more serious issue than merely access to technology. Beland and Murphy (2015) conclude that the academic success of low-achieving students is negatively impacted by the distractions mediated by mobile phones in school environments which lack support for structured use. It then is not the lack of but the access to technology that makes students fall behind even more. Based on the studies presented in this thesis and Grönlund, Andersson and Wiklund's (2014) finding that equality depends more on schools' pedagogical response to technology than access to technology, it is important that issues of equality not be reduced to access to mobile phones. The actual issue of equality is when schools do not consider the mobile phone to be a cultural tool and part of the school environment and consequently do not constructively address the fact that some students cannot handle mobile phones in beneficial ways.

6.2.3 MOBILE PHONES AND THE CLASSROOM ROLES OF STUDENTS AND TEACHERS

When schools do not distribute mobile phones as tools for learning, it is difficult for schools to initiate any use of these tools. Consequently, schools cannot exert much control over use of these tools or students' development of learning strategies involving use of mobile phones. This situation is a challenge to the monopoly of school and policy makers who are unable to prescribe which tools should be applied in education. This process has consistently been framed as a threat to teachers' authority. However, as Sharples et al. (2014) suggest, it can also be understood as an adjustment of the roles of teachers and students.

Historically, a variety of ICT has been suggested to be challenges to the taken-for-granted roles of students and teachers in the classroom (Cuban,

1986; Karlsohn, 2009). Along with books and other faculty-selected learning materials, teachers traditionally have been considered to be the primary sources of knowledge in education. Most recently, connected technology such as the mobile phone, tablet and laptop have challenged the figure of the teacher. When schools no longer have the monopoly on the distribution of technology used in learning, teachers no longer have the monopoly on the distribution of information in the classroom. As suggested by Philip and Garcia (2015), the directionality of education starts to shift. Students are no longer solely served learning content but can more actively demand to learn content beyond what the teacher prepares. This change from a push to a pull learning directionality challenges teachers to be attentive to students as learners.

In research on technology use in school, searching for information has been labelled a low-level use (Ertmer, 2005). Searching for information might seem simple, but access to needed information at the time it is needed endows the students in Ott et al. (2017b) with new properties as agents in their learning. In the mobile learning literature, these new properties are considered to be opportunities to gain information and to engage in learning independent of place, time or contextual boundaries. They are described as opportunities for learners to learn *anywhere* at *any time* (Traxler, 2007).

If the contextual mobility of the learner is considered, the most compelling observation from a learning perspective is that use of the mobile phone has the potential to provide access to remote people and learning resources (cf. Kukulska-Hulme, 2010) not present within the context of classroom activities. Such access could aid students in entering the zone of proximal development (Vygotskij, 1978), but this process of entering the zone of proximal development shall not be taken for granted. To some extent, students already have the possibility to engage in this procedure, but connected technology also makes off-task usage easily accessible (Ragan, Jennings, Massey, & Doolittle, 2014). The temptations from the mobile phone are the strongest during the gaps in lessons (Olin-Scheller & Tanner, 2016). In such gaps or when students get stuck and have to wait for the teacher's assistance, they habitually start to use their mobile phones for off-task usage. Reengaging in learning when the resistance in the learning process is already so intense that the student needs support is difficult

(Ott et al., 2017b). Based on these studies which indicate that some students manage to use their mobile phones for learning in these situations, schools could decrease the distractions from mobile phones and benefit students' learning by encouraging and instructing students in how to use their mobile phones to reengage in their schoolwork by accessing sources information beyond the classroom.

Although mobile phone usage can be permitted by teachers and performed used by students, all the groups of stakeholders, even the students in Ott et al. (2017b), still view the mobile phone as a disturbing technology. Ott (2014) shows that in the history of mobile phones in school, policy makers and media pundits have generally agreed that it is a technology that causes disturbances and distractions in the school learning environment. Encouraged by such views, the mobile phone has become a symbol of youthful disrespect for adult authority. Students adapt to local rules, but the small size of the mobile phone allows it to be smuggled into the classroom in violation of bans, and if the students are not disruptive, teachers might look the other way (Charles, 2012). If mobile phone use is restricted, using the device can be an intentionally subversive act by students (Kukulska-Hulme et al., 2009). However, there is a difference between being intentionally subversive of teachers' authority and habitually using a mobile phone despite a personal belief that it is disrespectful.

That teachers permit certain uses more frequently than others indicates that they hold certain expectations of what education should be and what practices and content education should involve. That content then can be considered to be an indication of on what values education should rest. Part of schools' mission is to communicate the values and norms of society (Selwyn & Bulfin, 2016). Consequently, the disciplining of youth culture is natural to schooling, and indeed, disciplining is an element present in the studies. For example, teachers who have difficulties with mobile phones express appreciation for regulations and sanctions against mobile phones in school. So do the students who express that in school, students should pay attention to their teachers and view the confiscation of mobile phones as acceptable. However, this belief exists more in principle than in practice.

6.2.4 MOBILE PHONES AND IMPACTS ON SCHOOL PRACTICE

If the mobile phone is understood as a disturbing object or a tool, it can be considered using the three levels of challenges suggested by Bygholm and Nyvang (2009). Level-one challenges concern practical matters, such as how to use a mobile phone, in the empirical material these do not emerge as any major problems. Level-two challenges are more common, and in the empirical data, there is a constant discussion on when and for what to use mobile phones. Level-three challenges are also present, since the discussion in the print media itself might be an expression of the lack of understanding of how technology use influences core values and concepts of practice.

There is no consensus on what to do with the mobile phone in school. However, as Star (2010) states, consensus is not necessary for cooperation to function. Instead, boundary objects emerge, enabling various groups to make local arrangements concerning a mutual issue. Even if the mobile phone does not radically transform learning in school, it can persist within school as a boundary object. It is as if the tensions surrounding the mobile phone distract policy makers, teachers and students from noticing that while they struggle with the interpretive flexibility and the reinforcement of the local sense-making of the boundary object, practice and technology use gradually are developing reciprocally, as suggested by Orlikowski (1996). In this process, the mobile phone has almost unnoticeably become part of the infrastructure for learning in upper-secondary school.

6.3 FROM DISTURBING OBJECTS TO INFRASTRUCTURE

When using the notion of infrastructure, the relational properties of infrastructure imply that the understanding of infrastructure should be grounded in practice (Star, 1999). For this purpose, the practice lenses suggested by Orlikowski (2000) are useful and support the understanding that infrastructure emerges through practice. Infrastructure is an infinite, complex ecology of social and technological features and relationships. Although no definition of infrastructure can be comprehensive, some essential elements of the infrastructure related to a specific practice or

technology can be identified. In this thesis, the technology is the mobile phone in school practice. The practice lenses reveal that school infrastructure for learning is both local and global. These lenses also identify the resources that come into play: policy documents, such as the school law and curricula; humans, such as policy makers, teachers and peers; material and symbolic social and institutional arrangements, such as schools' WiFi system, the classroom, the LMS, school organisation, lectures and tests; and technological resources, such as the Internet, social media, computers and sometimes mobile phones.

Understanding infrastructure as emerging and possessing the eight dimensions suggested by Star and Ruhleder (1996), the empirical data show that students' mobile phones are *embedded* into school practice as they are ever-present. Students use them to communicate with each other. The mobile phone complements other technologies, and the features enabled by the connected mobile phone are mediated not only by the mobile phone. Social media and access to the LMS are examples of uses not dependent on the use of the mobile phone but facilitated by the mobile phone.

The mobile phone regularly brings distractions, such as social media, into school, so the device can be identified as infrastructure for those distractions. In schoolwork, the mobile phone is *transparent* as long as its use is not hindered. When teachers implicitly permit students to use mobile phones by not suppressing their use, the mobile phone becomes a transparent part of the infrastructure for learning. The mobile phone enables communication and access to functions that have *reach* over time and place. In mobile learning, mobility has certain core characteristics. The mobile phone acts as a boundary object that opens up the social world of school to the social worlds outside school, and vice versa.

Teachers who permit usage of mobile phones and students who use mobile phones learn that usage *as members* of school practice. These teachers and students become brokers who have learned to identify situations and usage areas where the mobile phone can serve as a tool in school practice. These students explain that they are distracted when they, either through confiscation or warnings, are deprived of the option to use their mobile phones by teachers who do not recognise the mobile phone as infrastructure for learning in the same way that they do. However, among

students, the mobile phone is foremost not an infrastructure for learning but an infrastructure for leisure and socialising.

The mobile phone is difficult to *link with the conventions of practice*. The mobile phone functions most accepted are doing calculations, listening to music and taking photos of the white board. These functions align with the conventions of practice. Listening to music isolates students working individually, and taking photos of the white board documents what the teacher has taught. Being in contact with people or content outside the classroom, in contrast, is usually not a convention of practice. The mobile phone has technological features that plug it into the technological arrangements of schools, such as the LMS. As a mutable technology, the mobile phone can *embody standards*, and the user personalises it with the software and functions needed to participate in whatever practice the user wants.

The mobile phone and the tensions surrounding it in school can be understood as challenging the *installed base* of school's infrastructure for learning. The mobile phone challenges the teacher, the classroom and the resources in which the school has invested. The mobile phone inherits the limitations of these components of the infrastructure. For example, the limitations of the classroom are projected on to the mobile phone. The mobile phone is anything but locked in the temporal, spatial and contextual boundaries of the classroom, but in school, the isolation of the classroom is the standard, and the mobile phone is expected not to interfere with that isolation.

Digitalisation has put schools and teachers under pressure to pick up on teaching and learning mediated by a myriad of digital technologies (Cuban, 2013; Karlsohn, 2009). In this process, numerous stumbling blocks have caused breakdowns in the infrastructure for learning in school. The studies in this thesis focus on the *breakdown* potentially caused by the mobile phone. The breakdown has manifested in turmoil in the school work environment, in the reported disturbances and in the distractions from the mobile phone. Laptops and tablets likely also have caused breakdowns that have exposed the infrastructure for learning in school to academic discussion and public debate on what school's infrastructure for learning should and should not be.

In this context, the mobile phone presents an especially interesting exception. Unlike laptops and tablets, the mobile phone has not been assigned any formal purpose in the infrastructure for learning. Instead of developing a planned integration of the mobile phone into the infrastructure for learning in school, authorities have met the presence of the mobile phone in school with regulations, as described in Ott (2014), Ott et al. (2017b) and (Ott et al., 2017a). However, these regulations have proven to be insufficient and have not decreased the number of students' mobile phones in school. Moreover, the regulations have signalled that the mobile phone does not belong in school practice, which has made it difficult to assign it any formal purpose in school. The breakdown follows the logic of Guribye (2005), who argues that a technology is bound to influence on the practice enabled by the surrounding infrastructure, so one cannot expect an infrastructure to keep functioning as before a new technology appeared. However, breakdowns are not permanent conditions, even if the breakdown caused by the mobile phone persists.

6.4 INFRASTRUCTURING MOBILE PHONES

Infrastructure is developed and maintained through use and implicit negotiations in practice (Star & Bowker, 2006). When students utilise the mobile phone in practice, and teachers respond to that utilisation, an implicit negotiation takes place (Charles, 2012). As teachers explicitly and implicitly give students permission to engage in certain tasks supported by their mobile phones, certain uses slowly but surely become naturalised parts of schoolwork. The explicit debate over what technology to include in the infrastructure for learning on a formal level is complemented by implicit negotiations in practice. These are connected, for example, by the formal and informal values communicated by the classroom regulations. These values are neither static nor general but, as Bielaczyc (2006) argues, constitute an infrastructural dimension of cultural beliefs open for design and analysis.

The empirical material reveals that functions perceived as mediating disturbing behaviours can be negotiated into infrastructure resources. In all the groups of stakeholders, some individuals describe themselves as disturbed by mobile phones. The descriptions of the disturbances in the

classroom environment reflected in the public debate provide an account of the noticeable nuisances from the mobile phone in school in the years before the other three studies in this thesis were conducted. For example, the newspapers report that schools found the ability to take photos troublesome and challenging to handle. The empirical data, though, show that years later, the students used their mobile phones to take photos for pedagogical purposes, sometimes encouraged by their teachers. In this way, the photo function of the mobile phone became a resource in the infrastructure for learning in school. Yet another function depicted in newspapers as a disturbance in the learning environment is the use of MP3 players, which years later were integrated into the mobile phone and used by students to gain focus on schoolwork.

However, the stakeholders still discuss the mobile phone as a contested technology in school. One explanation of the problematic cultural value that the mobile phone has gained in school is that the device's most-used applications are not designed to be used in education (cf. Traxler 2007). However, when the manufacturers' design process ends, the actual use of that design is negotiated through use by the participants in social practices in the process of infrastructuring (Pipek & Wulf, 2009). As infrastructure grows, its resources' cultural values and history change.

The mobile phone must be acknowledged as a tool for learning to completely become part of schools' infrastructure for learning, which is probably necessary for the device to become less a of source for breakdown in school infrastructure. First, the data from the studies describe a complex situation, with no consensus on what to make of the mobile phone in school. The stakeholders seem to have difficulty not letting the perception of the mobile phone as a disturbing technological device obscure a more nuanced approach building on usage. Even if the mobile phone seems to remain a stable object, its properties multiply and are designed to be personalised and ultimately modified. With every new application, the properties of the mobile phone change. Even if emerging mobile phone uses (as in the case of cameras, music players and web browsing) are naturalised in the infrastructure for learning, new software and new features integrated into the mobile phone will every now and then cause tensions in school practice. If stakeholders continue to respond to such recurring tensions by calling for a ban of mobile phones in schools, there

is a risk that mobile phones in school will become a wound that never heals. Instead, schools should engage in the process of infrastructuring and more actively negotiate usage with students.

This thesis has shown how the mobile phone has caused tensions in school practice. However, upper-secondary schools have, albeit reluctantly, added the mobile phone to their repertoire of tools for schoolwork. It is now time for policy makers, students and teachers to recognise the mobile phone as the resource in the infrastructure for learning in upper-secondary school that, in many ways, it has already become.

6.5 RE-CONNECTING TO PRACTICE

I first became aware of the tensions surrounding mobile phones in school in 2007 while working as a teacher. In that same year, teachers were granted with legal authority to confiscate disturbing objects in school. In the discussions in media and among the students and the teachers at the school where I worked, there was no doubt that the legislation was aimed at students' mobile phones. However, among the teachers, there was general agreement that mobile phones were not an urgent challenge to school practice.

As I continued my work as a teacher, I noticed that somehow the issue of mobile phones in school was not defused by the legislation. Rather, teachers become vigilant for potential disturbances and distractions from mobile phones. At the same time, the basic mobile phone was starting to be replaced by the smartphone, and a growing number of applications and services were developed and used. The mobile phone became more intertwined with the activities of daily routines and social life.

When I began this research, I had only a vague sense of how to understand the tensions surrounding mobile phones in school. I could see that factors external to the classroom such as public debate influenced school practice. I started by using historical materialism and boundary crossing to theoretically explain the tensions. As I continued my research, my theoretical toolbox grew, and eventually, I encountered the notion of infrastructure as suggested by Star (1996) and the application of the concept on learning activities and environments (Guribye, 2005; Guribye & Lindström 2009). The notion of infrastructure provided a framework that

allowed exploring the dynamics of the social and technological arrangements in and beyond school. Moreover, the infrastructure concept did not oppose either boundary crossing or historical materialism; instead, the different theories completed each other.

This thesis has shown that despite the tensions surrounding mobile phones, they have become tools used in school practice. I hope that this thesis will contribute to school practice by nuancing the perceptions of mobile phones in school. Understanding mobile phones with the notion of infrastructure can provide relevant perspectives on students' use of mobile phones in school beyond the image of the mobile phone as a disturbing object. Then, if addressed constructively, the tensions surrounding mobile phones in school might be resolved or at least reduced. I do not think that this goal can be accomplished with ease, but I do believe that integrating such a powerful tool as the mobile phone into the infrastructure for learning in school would benefit both students and teachers as participants in digitalised society.

CHAPTER 7

SWEDISH SUMMARY

INTRODUKTION

Den här avhandlingen behandlar de spänningar som har uppstått kring mobiltelefonen i skolan. Spänningarna har följt på det att mobiltelefoner har blivit vardagteknologi i det digitaliserade samhället. Som något som vi ser och möter mer eller mindre överallt, framstår mobiltelefonen som en konkret representation av digitaliseringen. Att samhället digitaliseras innebär inte bara att vi byter från digital till analog teknologi, digitaliseringen innebär också genomgripande förändringar av vår livsföring. Samhälleliga funktioner så väl som våra sätt att umgås och arbeta förändras genom vår användning av digital teknologi. Utbildningssektorn lämnas inte oberörd. Den digitala teknologins påverkan på skolan är dock inte entydig. Genom åren har stat och kommuner gjort stora investeringar för att utrusta den svenska skolan med digital teknologi. Under senare år har investeringar i s.k. 1:1-projekt ofta ersatt eller kompletterat skolors tidigare investeringar i datorsalar. 2015 försågs hela 3/4 svenska gymnasielever med en dator

av sin skola. Att investera i 1:1-projekt har bidragit till stora kostnader för skolan och både i Sverige och internationellt diskuteras nu upplägg där eleverna i stället själva ska ta med sin egen teknologi, s.k. Bring Your Own Device (BYOD). Parallellt med att skolan har investerat i digital teknologi har eleverna också på eget initiativ tagit med sin egen teknologi till skolan, ofta mobiltelefonen. Detta har inte skett som del i något BYOD-initiativ, utan för att det är så ungdomar gör. I stort sett alla gymnasielever i Sverige har en egen mobiltelefon, och den har de alltid med sig överallt. Mobiltelefonen används också ofta för att utföra uppgifter i anslutning till skolarbetet. Det har dock visat sig vara ett svårt dilemma att förena användningen av mobiltelefoner med skola och undervisning; inte sällan har elevernas användning av dem i klassrummet upplevts som störande. Detta dilemma har tagit sig uttryck i en återkommande offentlig debatt om hur man ska hantera att eleverna har med sig sina mobiltelefoner till skolan. Dilemmat har också dragit till sig intresse från vetenskapligt håll och forskningsfältet mobilt lärande (mobile learning eller m-learning) har vuxit fram. För mobilt lärande är det en fundamental utgångspunkt att mobil digital teknologi som t.ex. mobiltelefonen är användbar för lärande. Frågan vad man ska göra med mobiltelefonerna i skolan är mångbottnad, och berör flera grundläggande frågor om skolan, t.ex. hur skolan ska förhålla sig till samhällets förändringar, varav digitaliseringen är en synnerligen genomgripande sådan.

I den offentliga debatten har mobiltelefonerna i skolan beskrivits som störande och distraherande. Både internationellt och i Sverige har det stiftats lagar med syfte att minska förekomsten av mobiltelefoner i skola och undervisning. Detta har lett till en situation där lärare och elever uppmuntras att använda vissa digitala teknologier, t.ex. datorer och datorplattor som skolan behöver investera i, medan användningen av annan liknande teknologi, mobiltelefonen, som eleverna redan har tillgång till beivras. En lag får sin styrka genom tillämpningen av den och i klassrummet är det lärarna som ska göra bedömningen när lagstiftningen ska tillämpas, och alla lärare uppfattar inte användningen av digital teknologi och mobiltelefoner i klassrummet på samma sätt. I klassrummet uppstår då en implicit förhandlingssituation mellan elever och lärare om hur och till vad teknologin kan och bör användas. I denna förhanslingsituation får sociala och kulturella värden stor betydelse för hur de inblandade parterna

t.ex. lärare, elever och beslutsfattare agerar. Här uppstår ett slags gränsland i vilket eleverna blir tvungna att anpassa sin användning till olika lärares individuella tillämpning av den lag som ger dem tillåtelse att beslagta föremål som stör i klassrummet.

I den här avhandlingen betraktas skolan som en social verksamhet, vars aktiviteter möjliggörs av en infrastruktur för lärande som består av sociala som materiella resurser (Guribye & Lindström, 2009). Detta är ett sociokulturellt perspektiv som manifesteras genom användningen av infrastrukturbegreppet (Star och Ruhleder 1996) som syntetiserande analytiskt verktyg för att öppna upp de utmaningar som mobiltelefonen inneburit för skolan. Ur ett sådant perspektiv fångas dynamiken i de socio-teknologiska arrangemangen upp och de inblandade intressenternas ståndpunkter gällande skola och teknologi blir viktiga. Det blir också viktigt att tillmäta teknologin betydelse som medierande av mänskliga aktiviteter. Infrastruktur är inte en lokal företeelse och skolans infrastruktur för lärande sträcker sig utanför klassrummet och skolan. Därför påverkas verksamheten i skolan inte bara av aktörer i skolan. Intressenter utanför skolan kan vara till exempel politiker, som ofta ger ofta uttryck för sina ståndpunkter i den offentliga debatten. För att förstå hur utmaningarna från mobiltelefonerna i skolan vuxit fram blir det därför intressant att studera den offentliga debatten ur ett historiskt perspektiv. I skolan är det dock elever och lärare som är de centrala aktörerna. Eftersom lärare har fått ett tydligt lagligt utrymme för att kunna beslagta elevers mobiltelefoner under skoltid, blir det också intressant att studera hur lärare tillåter användning av mobiltelefoner under sina lektioner och vilka faktorer som påverkar deras agerande. Anledningen till att det uppstått spänningar i skolan kring mobiltelefoner är att eleverna tagit med sig sina mobiltelefoner in i skolan. Det blir därför också viktigt att elevernas synpunkter får utrymme i analysen. T.ex. blir det viktigt att undersöka hur eleverna ser på lärarnas tillämpning av lagstiftningen.

Genom att mediera sociala aktiviteter kan mobiltelefonerna överbrygga mellan elevers olika livsvärldar, t.ex. i skolan och utanför skolan. När olika villkor gäller för deltagande i sociala aktiviteter i skolan och utanför skolan blir det också viktigt att studera hur elever ser på mobiltelefonerna i skolan och utanför skolan.

SYFTE OCH FRÅGESTÄLLNINGAR

Det övergripande syftet med avhandlingen är att kritiskt undersöka mobiltelefonen[3] som ett möjligt verktyg för lärande på gymnasienivå. I fyra separata studier har avhandlingens tre forskningsfrågor adresserats. Forskningsfrågorna är:

1. Vilka spänningar kring mobiltelefoner i skolan har blivit tydliga i den offentliga debatten?

2. Vilka faktorer påverkar lärares tillåtelse av elevers mobiltelefonanvändning under lektionstid?

3. Hur uppfattar eleverna mobiltelefonen som ett verktyg i skolverksamhet?

BAKGRUND OCH FORSKNINGSÖVERSIKT

Att använda informationsteknologi i skolan är ingen nymodighet. Både i Sverige och internationellt har det under långtid förts diskussioner om betydelsen av teknologi i undervisningen. Tanken om att använda film, radio och TV har alla föregått dagens diskussioner om att använda digital teknologi av skolans undervisning.

Sverige har traditionellt sett legat i framkant, sedan 1960-talet fram till i dag har viljan och förståelsen för att investera i datorer varit stor från stat och skolhuvudmän. I och med att datorerna blev vanligare under andra halvan av 1980-talet inleddes också en offentlig debatt kring behovet av att förse skolor med modern informationsteknik. Det var en debatt som växte sig starkare i takt med att den svenska IT-bubblan blåste upp under 1990-talet och som sedan kom att kulminera runt år 2000. I skolorna genomfördes under den perioden flera stora projekt för att få ut teknologi i verksamheterna, Fyrtorns-projekten och ITiS hör till de större och mer välkända. De stora statliga satsningarna på att förse skolor med datorer,

3 Med undantag för om någon specifik teknologirelaterad poäng ska göras benämns i den här avhandlingen både mobiltelefoner och smarta mobiltelefoner som mobiltelefoner.

ersattes under 2000-talet av mer lokala 1:1-satsningar. Dessa har huvudsakligen motiverats med tre argument: det första är att datorer är moderna verktyg som används i hela samhället, det andra är att datorer skulle kunna förbättra utbildningen och det tredje är att datorer är förhållandevis billiga jämfört med att investera i andra resurser. För datorer har framför allt de två sistnämda argumenten visat sig vara problematiska, om man tillämpar argumenten på mobiltelefonen blir även det första problematiskt.

En mobiltelefon är idag inte en apparat bara för att ringa telefonsamtal. Det är inte självklart var gränsen mellan en dator, datorplatta och en smart mobiltelefon ska dras, tekniken är ofta lik och en modern smart mobiltelefon kan ha lika mycket processorkraft som en dator. Ett sätt att förstå skillnader mellan de olika teknologierna kan vara att ta fasta på att mobiltelefonen har användaren till skillnad från en dator oftast med sig och användningen är inte lika styrd av att en speciell uppgift ska utföras (Traxler, 2007). Skillnaden mot en datorplatta kan nog bäst förstås utifrån skillnader i storlek och uppkoppling. I skolan har mobiltelefonerna inte blivit lika spridda som datorer och datorplattor.

Den svenska läroplanen för gymnasieskolan anger att skolan har ett ansvar att tillse att alla elever kan använda olika resurser för att söka efter kunskap, kommunicera, bejaka sin kreativitet och för att lära. Gymnasieskolan ska förbereda eleverna för ett liv i en föränderlig värld med ny teknologi och högt informationsflöde (Skolverket, 2013). Mobiltelefoner nämns inte specifikt i läroplanen, men det betyder inte att inte finns ett regelverk för mobiltelefoner i gymnasieskolan. Den svenska skollagen (SFS. 2010:800) slår fast att föremål som hotar säkerheten, eller stör undervisningen får beslagtas av lärare. Även om mobiltelefoner inte nämns specifikt i lagen heller, är den applicerbar också på mobiltelefoner som störande föremål (Skolverket 2016). Möjligheterna med att använda mobiltelefoner i utbildningen har ändå lyfts av Skolverket inom arbetet med att uppdatera läroplanerna. Då har det handlat både om användning av pedagogiska appar på mobiltelefoner och om mobiltelefonen som en teknologi inom BYOD. Hittills har BYOD dock avfärdats med argument som byggt på att det inte går att förena BYOD med tanken om en likvärdig skola. Skolan kan inte förlita sig på teknik som den inte själv tillhandhåller.

Den här avhandlingen behandlar spänningar kring mobiltelefoner i en formell lärmiljö och bidrar till forskningsfältet mobilt lärande. Inom

mobilt lärande betonas flera olika sorters mobilitet: bl.a. rumslig, temporal och kontextuell. Den definition av mobilt lärande som den här avhandlingen tar fasta på är att mobilt lärande är ”Lärande över multipla kontexter, genom social och innehållslig interaktion, med hjälp av elektroniska apparater” (Crompton, 2013a, p. 4, översättning från engelska). Mobilt lärande kan då äga rum var som helst, också i klassrummet. Forskningsfältet har sin grund i visionära tankar kring teknologi och lärande från början av 1970-talet, men började finna sin nuvarande form som mobilt lärande i början av 2000-talet. Forskningen inom mobilt lärande har många gånger varit småskalig och experimentell, ofta har den bedrivits i informella lärmiljöer. Forskning på mobilt lärande inom den formaliserade utbildningen har ofta bedrivits på högre utbildning eller i lägre åldrar, m.a.o. det finns ett behov av mer forskning kring mobilt lärande på gymnasienivå.

Forskning kring mobiltelefoner i skolan generellt pekar på att förbud mot mobiltelefoner i skolan är vanliga internationellt (Kukulska-Hulme m.fl., 2009; Pachler m.fl., 2013; Thomas & Muñoz, 2016), men även om skolorna förbjuder användningen av mobiltelefoner tar eleverna med sig dem (Charles, 2012; European Commission, 2013; Kukulska-Hulme m.fl., 2009). I skolan kan mobiltelefoner vara störande (Berry & Westfall, 2015; Mifsud, 2014), och har använts för att fuska (Campbell, 2006; Thomas, O’Bannon, & Britt, 2014), sms:a under lektionstid (Katz m.fl., 2014), cybermobbing och sexting (sms:ande med sexuellt innehåll) (Thomas & Muñoz, 2016), för att komma åt sociala medier och spela spel (Lindberg, Olofsson, & Fransson, 2016) och för att lägga upp filmer online (Mifsud, 2014). Att förbud kan ha en positiv inverkan på skolgången för lågpresterande elever har också uppmärksammats (Beland & Murphy, 2015).

Det finns också forskning som pekar på att mobiltelefonen kan vara användbar i skolan och i klassrummet (Campbell, 2006; Peck m.fl., 2015; Sharples, 2013). Då kan spänningarna kring mobiltelefonen sättas i en längre tradition av störningar i undervisningen, där mobiltelefonen bara är den senaste i raden av störningar (Hassoun, 2014). Att mobiltelefoner upplevs som störande har också kopplats ihop med en rädsla för förändring av den traditionella undervisningsmodellen med en förläsande lärare (Pachler m.fl. 2013). Mifsud (2014) menar att lärarna utmanas av mobilt lärande eftersom det sätter eleverna i kontakt med kunskap som distribuerats utanför klassrummet och utom räckhåll för lärarens påver-

kan. Inom forskningen har det lyfts användningsområden där mobiltelefonerna i skola och utbildning kan stötta t.ex. användningen av digitala responssystem (Vavoula m.fl., 2005), interaktionen mellan föreläsande lärare och publik genom skapa möjlighet att skicka meddelanden i realtid (Cobb, Heaney, Corcoran, & Henderson-Begg, 2010), genomförandet av BYOD (Adhikari m.fl., 2012; Cochrane m.fl., 2014; Selwyn & Bulfin, 2016; Thomas & Muñoz, 2016), elevers motivation för skolarbete (Tessier, 2013), en autentisk utbildning (Roberson & Hagelik, 2012), arbetssätt som att "flippa" klassrummet (Fulton, 2012; Herreid & Schiller, 2013), åtkomsten till resurser på Internet (Thomas m.fl., 2014), kollaborativt lärande (Kukulska-Hulme, 2010).

Forskning visar också att lärare och elever upplever störningarna från mobiltelefoner olika. Elever är inte ensidigt positiva till att använda eller ens tillåta användning av mobiltelefoner i skolan, men de ser inte lika stora problem med det som lärare inom både högre utbildning (Baker, Lusk, & Neuhauser, 2012; Berry & Westfall, 2015), eller i gymnasiet (Lindberg m.fl., 2016). Att förbjuda mobiltelefoner kan medföra problem som t.ex. att eleverna blir frustrerade och tappar intresset för undervisningen när de inte får ha tillgång till den teknologi som de är vana vid att använda. På det sättet utmanar mobiltelefonen också skolutbildningens relevans i ett digitaliserat samhälle menar Hope (2013). Peck m.fl. (2015) menar att lärare som är tveksamma till användningen av IKT i undervisningen och därför försöker begränsa användningen av IKT i klassrummet generellt, i stället riskerar att eleverna använder sina personliga mobiltelefoner som ersättning för den teknik de berövats tillgång till.

TEORETISK INRAMNING

Den här avhandlingen bygger på sociokulturell teori med rötterna i Vygotskij (1978). Mänsklig aktivitet förstås som medierad av artefakter. Artefakterna får sin betydelse genom de sociala och kulturella värden de laddats med under sin historia. Det sociokulturella perspektivet manifesteras genom användningen av begreppet infrastruktur som ska förstås som en ekologi av sociala och materiella resurser som möjliggör mänskligt handlande och praktiker.

I de studier som ingår i avhandlingen används olika teoribildningar (gränsland, historiematerialism och infrastruktur) som på olika sätt ansluter till den sociokulturella teoribildningen genom att de kopplar ihop sociala och materiella aspekter.

Avhandlingen tar sin utgångspunkt i de spänningar (eng. tensions) som har uppstått kring mobiltelefoner i skolan. Spänningar som begrepp blir därför centralt och förstås som en konflikt som uppstår mellan två eller flera aktörer som förts samman av ett gemensamt intresse som det inte råder konsensus kring. En verksamhet kan dock fungera även utan att det råder konsensus mellan alla deltagare. Detta fenomen har teoretiserats som gränsland, gränsöverskridande eller gränsobjekt (Star & Griesemer, 1989; Akkerman & Bakker, 2009; Star, 2010). Ett gränsobjekt är en handling eller ett föremål som i användning skapar ett gränsland som både förenar och delar inblandade verksamheter, sociala världar eller infrastrukturer.

Infrastruktur är det mest centrala begreppet i avhandlingens sammanfattande analys. För det mesta tänker vi inte på den infrastruktur som möjliggör våra handlingar. Det är först när den havererar som vi blir medvetna om dess betydelse. Infrastruktur får sitt innehåll genom att den används och den består av såväl materiella som social resurser. Infrastrukturens olika beståndsdelar bygger på varandra i lager och är relationell i den mening att olika handlingar bygger på olika infrastruktur och någons handling kan vara någon annans infrastruktur (Star & Ruhleder, 1996). Infrastruktur kan förstås som uppdelat mellan två olika typer av infrastruktur: en universell infrastruktur tillgänglig för alla, och sedan olika verksamhetsspecifika infrastrukturer tillgängliga bara för dem som är deltagare i en specifik verksamhet. För dem som deltar i lärande aktiviteter kan man då tala om den verksamhetsspecifika infrastrukturen som en infrastruktur för lärande (Hanseth & Lundberg, 2001). En infrastruktur för lärande består av de sociala, tekniska och institutionella arrangemang och resurser som är designade för, eller avsedda att stödja lärande (Guribye & Lindström, 2009). I skolan kan det vara lärare, datorer, böcker, men också vaktmästare.

Infrastruktur är ingenting statiskt, den växer och förändras, resurser kommer till och resurser faller bort. Att infoga en ny resurs till en befintlig infrastruktur sker dock inte med enkelhet. Det är en kamp mellan gammalt och nytt. Många teknologier som utvecklas får ingen större spridn-

ing, och då de inte används blir de aldrig infrastruktur. Det är inte heller givet att det är den av utvecklarna designade användningen som blir den användning som blir infrastrukturerad. När användare av en teknologi formar dess användning i praktiken, bortom utvecklarnas räckvidd sker en *infrastrukturering*. En teknik som införs i en infrastruktur kan negativt påverka den verksamhet som den vedertagna infrastrukturen underbygger, därför är det av stor vikt att man funderar ordentligt över vilka roller man tilldelar teknologin som finns i en miljö. Parallellen till förekomsten av elevers mobiltelefoner i skolans infrastruktur för lärande och mobiltelefonernas påverkan på skolans verksamhet framstår som tydlig.

METOD

För att fånga komplexiteten i spänningarna kring mobiltelefoner i skolan är det empiriska materialet som avhandlingen bygger på genererat med flera olika metoder.

Tabell 2. Sammanställning av det empiriska materialet

	Metod	**Empiriskt material**	**Teoretiska perspektiv**
Artikel 1 (Ott, 2014)	Textanalys Statistisk analys	113 dagstidningsartiklar, 1996–2012	Historisk materialism
Artikel 2 (Ott m.fl., 2014)	Enkät med flervalsfrågor och öppna frågor.	28 besvarade enkäter	Gränsobjekt
Artikel 3 (Ott m.fl., 2017a)	Enkät	276 besvarade enkäter	Infrastruktur Attityder
Artikel 4 (Ott m.fl., 2017b)	Enkät med flervalsfrågor och öppna frågor. Fokusgruppsintervjuer	206 besvarade enkäter 19 fokusgruppsdeltagare	Infrastruktur

Att använda sig av en blandning av metoder speglar att skolans infrastruktur sträcker sig utanför skolans geografiska och konceptuella område. Intressenter med inflytande över skolans verksamhet finns på flera positioner i samhället. Genom att betrakta spänningarna kring mobiltelefoner i skolan genom tre olika *praktiklinser* (Orlikowski, 2000) synliggörs hur strukturer och infrastruktur runt mobiltelefonerna växer fram genom han-

dlingar i anslutning till skolkontexten. Tre olika praktiklinser används; en lins blickar in i den offentliga debatten, där politiker och allmänhet gör sig hörda, en lins betraktar gymnasielärare, och en tredje blickar in till gymnasieeleverna.

För att utforska hur mobiltelefoner i skolan uppfattats utanför skolans väggar använder Ott (2014) dagstidningsartiklar med ett innehåll som berör mobiltelefoner i skolkontext. Dagstidningsartiklar är historiska kvarlevor. Som berättande källor beskriver de inte med tillförlitlighet historiska skeenden, men som kvarlevor är deras källvärde stort. Genom att studera tidningsartiklar går det att få en bra uppfattning om vilka frågor och sociala värderingar som genomsyrar ett samhälle i ett historiskt skeende. Dagstidningarnas kronologi kan också användas för att studera hur en fråga utvecklas över tid. Artiklarna studerades därför både statistiskt utifrån publiceringsdatum, och innehållsmässigt genom en textanalys.

Lärarnas uppfattningar om mobiltelefonerna studerades utifrån ett identifierat gränsland, där lärarna genom lagstiftning har möjlighet att införa restriktioner av elevernas användning av mobiltelefoner i skolan. I detta gränsland finns också ett utrymme för lärare att tillåta elever att använda mobiltelefoner. Genom en enkät tillfrågades lärare vid 4 gymnasieskolor i en medelstor kommun om bl.a. deras tillåtelse av mobiltelefoner under lektionstid (Ott m.fl. 2017a). Svaren behandlades sedan statistiskt.

Elevernas uppfattningar av mobiltelefoner i skolan studerades i två separata studier. I Ott m.fl. (2014) fick gymnasieelever i en klass besvara en enkät om hur de använde sina mobiltelefoner för skolarbete i hemmet och vad det ansåg om att använda mobilerna för skolarbete i skolan. Enkäten innehöll både flervalsfrågor och fritextsvar, som analyserades både statistiskt och innehållsligt. I Ott m.fl. (2017) distribuerades en liknande enkät till gymnasieelever i två skolor i västra Sverige. För att få en djupare förståelse av elevernas uppfattningar, kompletterades enkäten med fokusgruppsintervjuer med totalt 19 elever. Resultaten analyserades både statistiskt och innehållsligt genom bl.a. en tematisk analys av fokusgruppsintervjuerna.

Kombinationen av metoder har bidragit till att skapa en bild där spänningarnas förändringar över tid framträder och där spänningarna belyses

från flera olika intressenters perspektiv. Det bidrar till forskningsresultatens validitet.

Alla studier har bedrivits med en stark etisk medvetenhet. Källkritik har tillämpats i granskningen av det historiska materialet och inga informanter ska gå att identifiera på individnivå. Respondenter har informerats om hur deras svar kommer att behandlas och informerat samtycke har insamlats där det behövts. Det har alltid funnits möjlighet att inte besvara någon fråga eller att avbryta sin medverkan.

SAMMANFATTNING AV DE EMPIRISKA STUDIERNA.

Avhandlingen innefattar fyra artiklar, varav två är publicerade i vetenskapliga tidskrifter, en i en konferensvolym och en artikel är i manusform.

I Ott m.fl. (2014) studerades den offentliga debatten utifrån två svenska dagstidningar, Dagens Nyheter och Aftonbladet. Utifrån publiceringsdatum och innehåll framträder en bild där det blir uppenbart att mobiltelefoner i skolan använts som ett slagträ i den politiska debatten. Under perioderna före och under valåren 2002 och 2006 märks en markant uppgång i antalet publicerade artiklar på området. Likaså under 2007 då regeringen införde ett tydligare lagutrymme för lärare att beslagta föremål som stör undervisningen, därefter avtog debatten något. Utifrån debatten kan man med säkerhet se att med störande föremål avses i första hand mobiltelefoner. En formulering som gång på gång återkommer i olika former är ”…mobiltelefoner och andra störande föremål…”. I nyhetsartiklarna beskrivs mobiltelefonerna med några få undantag som störande i skolan. Det är framförallt politiker som hörs i debatten, men lärare, elever och allmänhet förekommer också. De flesta politiker är överens om att det är självklart att mobiltelefoner inte ska användas i skolan. Lärare och elever verkar dock inte se mobiltelefonen som ett lika stort problem. Utifrån det historiematerialistiska perspektivet kan debatten förstås som ett uttryck för kampen om kontroll över skolans bas av produktivkrafter, som genom mobiltelefonernas förekomst och användning förändras.

I Ott m.fl. (2014) framkommer det att gymnasieelever använder mobiltelefoner för skolarbete hemma. De ser också flera möjliga användningsområden för mobiltelefoner i skolan, men är ändå ganska belåtna

med att inte använda dem. Som hinder för att använda mobiltelefonerna i skolan nämner eleverna att man kan fuska, skärmens format, störningar och lärare. I studien framstår mobiltelefonen som ett gränsobjekt mellan elevernas olika sociala världar i skolan och utanför skolan. På samma gång som det finns ett visst motstånd, för mobiltelefonerna in den sociala världen utanför skolan till skolan och skolans sociala värld till hemmet.

I Ott m.fl. (2017b) fick eleverna också svara på en enkät. Svaren på enkäten liknade i mycket de i Ott m.fl. (2014), men med den skillnaden att möjligheten att fuska inte nämndes som ett hinder på samma sätt. För att fördjupa förståelsen av hur gymnasieelever hanterar sin mobiltelefonanvändning i skolan följdes enkäten upp med fokusgruppsintervjuer. Det visade sig att de flesta elever uppfattar att mobiltelefonen har påverkat deras skolgång positivt. Även om det inte fanns några formella regler kring mobiltelefonanvändning på någon av skolorna kände eleverna till grundpremissen att de inte fick störa i klassrummet. Eleverna stödjer inte ett förbud, men kan se ett behov av tydligare regler. Hur dessa regler skulle se ut är svårt att utläsa, då ingen av eleverna vill bli drabbad av dem. Överlag anser eleverna att det är vars och ens ansvar att använda mobiltelefonerna på ett sånt sätt att de inte stör någon annan än de själva. Nästan alla elever använder mobiltelefonerna för skolarbete på något sätt antingen som stöd under lektionstid, eller för att organisera sig i klass- eller ämnesgrupper på sociala medier, men eleverna beskriver att vuxna har svårt att förstå att mobilen kan vara något annat än en leksak. Några elever föreslår också att skolan borde stötta elever i att utveckla en användning av mobiltelefonerna som stödjer lärandet i skolan. I artikelns anläggs ett infrastrukturperspektiv, som visar att eleverna använder mobiltelefonerna som infrastruktur för lärande, men att detta inte aktivt stöds av skolorna.

I Ott m.fl. (2017a) studeras lärares tillåtelse av mobiltelefoner under lektionstid. Resultaten visar att 72% av lärarna tillåter eleverna att använda mobiltelefoner under lektionstid, om än i låg utsträckning. Viss typ av användning är mer tillåten än annan, likaså finns skillnader mellan olika ämnen. Överlag visar resultaten att användning som är kopplad till skolarbete är tillåten i större utsträckning än privat användning, som att använda sociala medier eller spela spel. Användning som kopplar till skolans infrastruktur för lärande, som t.ex. att gå in på skolornas lärplattform tillåts i ganska högutsträckning. Resultaten visar att lärares tillåtelse av ele-

vers mobiltelefonanvändning inte är polär utan nyanserad. Lärares tillåtelse påverkas också av lärarnas attityder till IKT i skolan överlag. Lärare som ser mer positivt på IKT tenderar också att vara mer tillåtande av användningen av mobiltelefoner under lektionstid.

AVSLUTANDE DISKUSSION

Förekomsten av mobiltelefoner i skolan är resultatet av att eleverna själva har tagit med sig sin egen mobila teknologi till skolan. Detta borde vara goda nyheter för de som förespråkar mobilt lärande, men i skolan har mobiltelefonerna inte tagits emot med öppna armar. Tvärtom har mobiltelefonerna ställts mot en praktik med djupa traditioner kring hur undervisningssituationen ska vara beskaffad. Avhandlingens syfte är att kritiskt undersöka mobiltelefonen som ett möjligt verktyg för lärande på gymnasienivå och därigenom bidra till fältet mobilt lärande.

I den offentliga debatten har mobiltelefonen framförallt beskrivit som ett störande föremål. De spänningar som beskrivits rör t.ex. hur eleverna med mobiltelefonerna beter sig på sätt som lärarna inte känner igen. De deltar inte i klassrumsaktiviteterna på det sätt som lärarna avser. I debattens beskrivs detta som störningar i klassrumsmiljön och mobiltelefonen grupperas tillsammans med andra störande föremål som kepsar, tuggummi, snus, pinnar, video-spel, knivar, narkotika och fyrverkerier.

I debatten beskrivs också att det uppstår spänningar kring mobilen som utmanar lärarnas auktoritet, och att lärarna behöver fler disciplinerande verktyg att ta till för att kunna utöva sin auktoritet. I debatten lyfter dock inte lärarna fram mobiltelefonerna som något stort problem, och politikernas tal om lärarna behöver tydligare lagligt utrymme för att konfiskera mobiltelefoner utmanar därför också lärarnas auktoritet och professionella omdöme. En representant för elevkåren undrade också om lärare verkligen skulle klara av att beslagta störande föremål på ett rättssäkert vis. En annan elev undrade om mer disciplinerande åtgärder från lärarnas sida verkligen bidrog till ett bättre lärande. Eleven kände väl till vad som gäller i skolan och menade att hon ibland hade nytta av sin mobiltelefon. Att vissa elever betedde sig illa skulle inte skyllas på mobiltelefonerna. Dåligt uppförande var dåligt uppförande. I debatten är det mest de yngre som inte tar ställning emot mobiltelefoner i skolan.

Detta tyder på att det finns en spänning mellan äldre och yngre i debatten. De få politiker som ser en möjlighet att använda mobiltelefoner för lärande i skolan, tillhör också de en yngre generation politiker. För de yngre står mobiltelefonerna för något annat än för de äldre. För de yngre är mobiltelefonerna ett viktigt verktyg för att kunna delta i det sociala umgänget. Att eleverna tar med sig sina mobiltelefoner till skolan skapar en spänning mellan de som formulerar regler för skolan och dem reglerna gäller. Att eleverna äger sina egna mobiltelefoner och utvecklar sina egna metoder för användning av dem, utmanar de som skapar reglerna. När den teknologi som används mest inte är en som skolan tillhandahåller, minskar skolans möjlighet att påverka hur den används. På så vis utmanas läroplanens relevans och genomförandet av den gällande läroplanen. Gymnasiets läroplan innehåller formuleringar om att ”eleverna ska också kunna orientera sig i en komplex verklighet med stort informationsflöde och snabb förändringstakt” (Skolverket 2011 s. 7), de skulle kunna tolkas som uppmaningar att bejaka just de processer som mobiltelefonerna ger upphov till.

För att komma tillrätta med de spänningar som uppstått kring mobiltelefoner i skolan fick lärarna 2007 tydlig rätt att från elever beslagta föremål som stör eller hotar säkerheten i undervisningen. Lagen är inte skriven så att den kräver att lärare ska beslagta något, men den har öppnat upp ett gränsland för lärare att bedöma vad som är störande och inte, samt i vilken mån det blir ett bättre arbetsklimat av att beslagta en elevs mobiltelefon. För att förstå på vilka grunder lärare gör sina bedömningar blir det då relevant att studera sambandet mellan deras attityder till olika aspekter av skolan och deras tillåtelse av mobiltelefonanvändning under lektionstid. Tillåtelse behöver inte ges i form av att läraren uppmuntrar användning, utan kan förstås som att läraren bara inte försöker hindra någon elev från att använda sin mobiltelefon. Alla användningsområden är inte tillåtna i lika hög utsträckning. Det är framförallt användning som uppfattas som att knyta an till skolarbete som tillåts.

Även om lärare inte uppmuntrar användningen av mobiltelefoner i sin undervisning pekar tidigare forskning (ex. Charles, 2012) och Ott m.fl. (2017a) på att mobiltelefoner blivit verktyg som används för skolarbete. Utan att det stöttas i policydokument eller lokala regelverk är mobiltelefonen på väg att bli en del av skolans infrastruktur för lärande. Utan for-

mulerade regler eller policy, blir lärares uppfattningar om skola och utbildning av stor betydelse. Det empiriska materialet visar följaktligen att lärare som är mer positivt inställda till användning av IKT i undervisningen också är mer tillåtande av mobiltelefonanvändning än lärare som inte är så positiva till IKT. Richardson (1996) visar att lärares uppfattningar högre grad formas av verksamheten, än vad verksamheten formas av lärares uppfattningar. Därför, borde det vara så att lärare som tillåter användning av mobiltelefoner utvecklar sin syn på vad som är god utbildning, och blir mer positivt inställda till att tillåta mobiltelefoner när de ser att eleverna kan använda dem på sätt som stöder undervisningen. För de lärare som inte ser nyttan av IKT i undervisningen och därför är mindre tillåtande blir däremot lagstiftningen ytterligare en barriär som kan resas mot användningen av IKT i utbildningen.

Gymnasieelevernas uppfattningar kommer till uttryck både i deras explicita utsagor men också implicit i deras beskrivningar av hur de använder sina mobiltelefoner i skolarbetet. För de elever som deltagit i de studier som ingår i avhandlingen är mobiltelefonen både användbar och störande i skolarbetet. Flera elever uppfattar mobiltelefonen som underutnyttjad. De vet inte riktigt vad de ska ha den till och föreslår att någon form av träning i hur att använda dem kanske hade varit bra. Om datorer finns tillgängliga föredrar eleverna att använda dem. Att använda mobiltelefonen kan uppfattas som att man är respektlös mot läraren. Uppfattningar om att det var respektlöst speglades också i den offentliga debatten. Eleverna kände igen beskrivningarna från den allmänna debatten om mobiltelefonerna som störande, men delade inte den ensidiga bilden. Det visste att mobiltelefonen kunde vara störande och distraherande, men så länge man inte störde någon annan borde det inte vara något att bry sig om. Att engagera sig i utbildningen var vars och ens eget ansvar och de flesta elever beskrev att de använde sin mobiltelefon för att t.ex. ta anteckningar, organisera sina studier och sitt samarbeta med studiekamrater och för att söka på Internet, eller också bara för att kolla klockan.

För eleverna har mobiltelefonen blivit ett verktyg som de använder för skolarbete hemma och i skolan. De använder dem också för icke skolrelaterade områden i skolan. När de använder sina mobiltelefoner knyts elevernas olika sociala världar eller infrastrukturer samman mellan skolan och fritiden. Mobilen för in fritiden i skolan och skolan i fritiden. De elever

som klarar av att hantera detta har utvecklat en speciell gränslandskompetens som hjälper dem att förstärka flödena över gränslandet mellan det som är skola och det som inte är skola.

I de fyra delstudierna framkommer inte bara de inblandade intressenternas och aktörernas uppfattningar om mobiltelefonen i skolan. Det empiriska materialet speglar också skolan som situerad verksamhet, med en social och kulturell historia. Trots att mobiltelefonen som uppkopplad och mobil teknologi både kan användas och används för skolarbete, har den visat sig svår att förena med den traditionella skolundervisningen. En tradition som mobiltelefonerna utmanar är tanken om att undervisningen ska vara utformad så att utkomsten av den kan mätas genom att enskilt låta varje elev som individ kan redovisa sina kunskaper, d.v.s. göra ett prov. Den uppkopplade mobiltelefonen står i motsatsförhållande till ett sådant förfaringssätt och just möjligheten att fuska i skolarbetet har pekats ut som ett problem i tidigare forskning. Att skylla på att mobiltelefonerna är uppkopplade är inte en fullständig förklaring då det i skolan finns annan teknologi som också är uppkopplad, t.ex. laptops. Värt att notera är att utifrån tidigare forskning och den här avhandlingens studier verkar det som att fusk med mobiltelefoner är ett problem som i första hand inte lyfts av eleverna. Eleverna i Ott m.fl (2014) nämner visserligen fusk som hinder, medan eleverna i Ott m.fl. (2017b) inte nämner fusk som ett hinder. Det kan finnas fler skäl till detta, ett kan vara att jämfört med tidigare forskning som ofta byggt på enkäter med frågor som tydligt erbjuder eleverna att peka ut fusk och *sexting* som alternativ, fick eleverna i Ott m.fl. (2017b) istället svara i fritext och eftersom fusk inte är ett stort problem nämnde de inte fusk, å andra sidan besvarade eleverna i Ott m.fl. (2017b) inte enkäten anonymt, vilket kan ha fått dem att inte vilja nämna fusk. Eleverna var inte heller de samma i de två studierna. Ytterligare en förklaring kan vara att eleverna i Ott m.fl. (2017b) känner till skolans konventioner och vet vad som är acceptabelt att använda mobilen till i skola. Att fusk är ett problem verkar vara en uppfattning som kommer främst från en äldre generation av lärare, politiker och forskare.

Om man trots allt accepterar att det i vissa situationer kan skapa problem att mobiltelefonerna är uppkopplade, skulle man ändå kunna tänka sig att de är utrustade med funktioner som inte kräver uppkoppling för att vara användbara. T.ex. fungerar kameran eller kalkylatorn lika bra utan uppkop-

pling, men det är svårt för lärare att kontrollera vad eleverna gör och om mobiltelefonen är uppkopplad eller inte. Att begära att ha rätt att se vad eleverna håller på med i sina privata mobiltelefoner är en åtgärd omgiven av en svår etisk problematik. Att förekomsten av mobiltelefoner bygger på privat ägande är också en fråga som har adresserats ur ett jämlikhetsperspektiv. Skolverket (2016c) stöder sig på skollagen (SFS. 2010:800) och hävdar att eftersom utbildningen ska vara jämlik, ska skolarbetet inte bedrivas med någon teknik utöver den som skolorna själva distribuerar. Faktum är dock att både forskning och rapporter pekar på att samtliga elever i gymnasiet har tillgång till en mobiltelefon, och så gott som alltid en smartphone. Jämlikhet handlar om mer än tillgång till teknologi. Beland och Murphy (2015) finner t.ex. att det är de lågpresterande elevernas resultat som försämras i skolor som inte gör något åt mobiltelefoner, d.v.s. varken förbjuder eller försöker inkludera dem i undervisningen. I de fallen är det inte tillgången till teknologin som är jämlikhetsproblemet, utan att mobiltelefonerna används till fel saker. Att skapa en utbildning som är jämlik vad gäller teknologi handlar om att utveckla en kompensatorisk pedagogik kring teknologin. Det är därför viktigt att jämlikhetsfrågan inte reduceras till en fråga om tillgång till teknologi, utan att lärare, elever och beslutsfattare istället ser till konstruktivt arbeta med att lära alla elever att hantera mobiltelefonen i skolan så att dess nyttoaspekter kan komma alla till gagn.

En försvårande omständighet är att när skolan inte längre har monopol på att distribuera teknologi blir det svårt för skolan att utöva något inflytande över hur teknologin används. Som en konsekvens av det har lärare själva utvecklat egna strategier för lärande med mobiltelefonernas hjälp. Detta har i sin tur inneburit en justering av förhållandet mellan elever och lärare. Historiskt sett har det flera gånger tidigare höjts röster som pekat på IKT:s förmåga att förändra den traditionella hierarkin mellan elever och lärare. När skolan var den som tillhandahöll alla utbildningens lärresurser och läraren var den självklara källan till kunskap, fanns inte de utmaningar som mobiltelefonerna och annan uppkopplad teknologi skapar genom att öppna upp klassrummet mot omvärldens enorma informationsflöde. Men, skolan har inte längre monopol på att distribuera teknologi, och inte heller monopol på att sprida information i klassrummet. På det viset utmanas den traditionella förmedlingspedagogikens klassrumslogik. Elev-

erna blir inte längre mottagare, de kan också börja efterfråga svar på frågor som ligger utanför det som är planerat för lektionen.

Att söka efter information har uppfattats som en lägre nivå (jfr. Ertmer, 2005) av användning av teknologin för lärande. Även om det kan tyckas vara alldagligt att söka efter svar genom att söka på nätet, ger det eleverna nya möjligheter att på egen hand bli mer delaktiga i sin utbildning. De kan var som helst och när som helst söka svar på en fråga. Inom mobilt lärande har detta kallats för att lära överallt och när som helst (eng. anywhere and any time). Sett ur det sociokulturellt perspektiv är det också intressant. Resultaten i den här avhandling och tidigare forskning visar att eleverna är mest känsliga för de distraktioner som mobiltelefonerna erbjuder vid de tillfällen då de kör fast i skolarbetet och behöver invänta lärarens assistans eller när undervisningen upplevs som tråkig. Vid de tillfällena tar eleverna fram sina mobiltelefoner och lyckas inte alltid återgå till skolarbetet efter det. Om eleverna i stället skulle tränas i att vid de tillfällena söka svar på sin fråga online, eller om undervisningen är tråkig och ostimulerande, söka mer intressant kunskap på egen hand, skulle de med hjälp av extern information kunna förflytta sig in i den proximala utvecklingszonen på egen hand. Vissa av eleverna i Ott m.fl. (2017b) berättade om att de kunde göra på precis de sättet. Trots detta ses användningen av mobiltelefonen som störande och respektlöst, till och med av studenter. I den allmänna debatten har tyckare i media och politiker beskrivit mobiltelefonen som störande och mobiltelefonen har blivit ett uttryck för ungdomars brist på respekt för sociala konventioner och en äldre generation. Charles (2012) visar att elever anpassar sin användning av teknologin till lokala förhållanden, men mobiltelefonens ringa storlek gör att den kan tas med in också i klassrum där den inte är tillåten och så länge eleverna inte stör ser lärarna mellan fingrarna. I klassrum där strikta förbud råder kan användningen av mobiltelefoner i stället vara en medveten provokation av läraren.

När lärare tillåter viss användning mer än annan signalerar det också lärarnas uppfattningar om vilka metoder som är accepterade, vad som är kunskap och vilka värden skolan ska förmedla. En del av skolans uppdrag är att förmedla samhällets värderingar (Selwyn & Bulfin, 2016). På så vis är disciplinering av ungdomskultur en naturlig del av skolan. I studierna syns också disciplinering som ett element. Lärare som upplever större bes-

vär med mobiltelefoner är mer positiva till gemensamma regler och att beslagta elevers mobiltelefoner. Elever som upplever att deras studiekamrater beter sig respektlöst, uttrycker att konfiskering kan vara bra. Ingen elev verkar dock uppskatta att få sin egen mobiltelefon konfiskerad.

Huruvida mobiltelefonerna i skolan förstås som ett verktyg för skolarbete eller ett störande föremål kan förstås som lärandeutmaningar på tre nivåer. Nivå ett handlar om att lära sig hantera och handha teknologin. Nivå två handlar om att lära sig använda teknologin situerat i skolarbetet. Nivå tre handlar om att förstå hur teknologin bidrar till att omforma värden och koncept inom verksamheten. Utmaningar på nivå ett förekom inte i det empiriska materialet. Utmaningar på nivå två var återkommande i materialet, och den allmänna debatten kan i sig själv förstås som ett uttryck för utmaningarna på nivå tre. Utmaningar på nivå två och tre kan bara lösas kollektivt.

Det empiriska materialet uppvisar inte konsensus för hur mobiltelefonerna ska användas, men konsensus är inte heller nödvändigt för att en verksamhet ska fungera. Istället blir mobiltelefonen ett gränsobjekt som de inblandade skapar lokala förhållningsregler kring. Även om mobiltelefonerna ännu inte förändrat skolan i någon större utsträckning finns de alltjämt kvar i skolmiljön. Medan lagstiftare och tyckare i media varit upptagna med att beskriva störningarna från mobiltelefonerna i skolan har användningen av dem för skolarbete gradvis, nästa omärkbart blivit en del av en infrastruktur för lärande för elever och lärare. Infrastruktur växer fram genom användning. Den här avhandlingen har visat att även om mobiltelefoner till skillnad från laptops och surfplattor inte formellt ses som delar i skolans infrastruktur, används de som infrastruktur, både av elever och av lärare. För att minska spänningarna kring mobiltelefoner i skolan är det antagligen nödvändig att omvärdera dem och börja se dem som verktyg som kan vara användbara i skolarbetet. När infrastruktur växer förändras också synen på dess beståndsdelar. En försvårande omständighet är att mobiltelefonerna inte är statiska. Nya applikationer tillkommer och utvecklingen av den allmänna debatten över tid visar att nya applikationer och funktioner skapar nya spänningar. Därför är det antagligen nödvändigt att förstå mobiltelefonen som en apparat med flera olika funktionsmöjligheter, både störande och nyttiga. Att svara på varje ny störning med att kräva förbud, riskerar att bidra till att skapa nya spän-

ningar och göra mobiltelefonen i skolan till ett sår som aldrig läker. Istället borde alla inblandade se mobiltelefonerna som den del av infrastrukturen för lärande den faktiskt har blivit och utifrån det diskutera och förhandla användningen med eleverna.

EN ÅTERKOPPLING TILL VERKSAMHETEN

Min förhoppning med den här avhandlingen har varit att bidra till en nyansering av bilden av mobiltelefoner i skolan. Att förstå mobiltelefonerna som infrastruktur kan ge nya perspektiv på elevernas användning av mobiltelefonerna utöver att de ses som störande föremål. Om sedan spänningarna som finns kring mobiltelefoner i skolan behandlas konstruktivt, kan de kanske minskas eller lösas upp och bidra till att stärka skolans verksamhet. Jag vill inte påstå att detta är en enkel sak att göra, men jag har en övertygelse att om det går att skapa en riktigt plats i skolans infrastruktur för lärande för ett så kraftfullt verktyg som elevens egen mobiltelefon, skulle det vara till godo för både lärare och elever verksamma i digitaliserade samhället.

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Part II

THE PAPERS

ARTICLE 1

A HISTORICAL MATERIALIST ANALYSIS OF THE DEBATE IN SWEDISH PRINT MEDIA ON MOBILE PHONES IN SCHOOL SETTINGS

Ott, T. (2014)
International Journal of Mobile and Blended Learning, 6(2), 1–14

A Historical Materialist Analysis of the Debate in Swedish Print Media on Mobile Phones in School Settings

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ABSTRACT

The use of mobile phones for teaching and learning in schools has been a controversial matter. In this paper the debate in two Swedish newspapers on the use of mobile phones in schools is analysed using a historical materialist framework. The results are discussed in relation to contemporary research on mobile learning. The analysis reveals that the debate has been a consequence of a conflict of control of the process of learning in schools. Statements from the stakeholders in the debate indicate that it primarily has been a conflict between those who rule school, the legislators, and those who are ruled, the school staff and the pupils. Knowledge of this could contribute to the understanding of difficulties occurring when implementing a mobile learning concept in the educational system.

Keywords: History, Mobile Learning, Mobile Phones, Newspapers, Policy, School

INTRODUCTION

Since the middle of the 1990s the use of mobile phones has penetrated every layer of society. In education, this process has been perceived both as a threat and as an opportunity and the debate has from time to time been intense. The use of mobile phones in schools can be dealt with as an extra-curricular problem, but it can also be put into the context of how a technology is taken up and adopted for pedagogical purposes, as a question of mobile learning (Sharples, 2002). Understanding how mobile phones are becoming tools in the traditional arena of education – the classroom – is an important research topic. This matter has many layers and can be regarded from different perspectives, e.g. educational, technological and political (Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sánchez, & Vavoula, 2009; Traxler, 2007). As Kukulska-Hulme et al. (2009) pointed out, political approaches are important for implementation of mobile learning in the educational system. This paper focuses on the interaction between educational and political aspects, as it is revealed in the public debate in newspaper articles of the past. The approach is similar to Karlsohn´s (2009), who analysed the rhetoric surrounding the introduction of ICT in Swedish schools during mainly the 1990s. The

DOI: 10.4018/ijmbl.2014040101

aim is to understand societal forces that are of importance for how mobile learning is dealt with in schools.

The overarching research question in the study presented in this paper is:

- What conflicts regarding the use of mobile phones in school can be traced in the public debate in the press?

Analytically a historical materialist perspective has been adopted.

HISTORICAL MATERIALISM

Historical materialism is based on a Marxist viewpoint on society. The structure of a society is regarded as being constituted in three levels. On the first level, the foundation, are the forces of production; tools, techniques, raw materials and labour power. On the second level are the relations of production; division of labour, cooperation and subordination to sustain the production. On the third level, the superstructure, are the legal and political institutions and their supporting ideologies (Tosh, 2002).

According to the perspective of historical materialism, the development of the human society is determined by the struggle for control of the forces of production. This implies a conflict between those who exercise control over the means of production (the superstructure) and those who carry out the production (the forces of production). The conflict is situated in the relations of production, through which the superstructure and foundational level influence each other.

With its affinity to Marxism, historical materialism is often interpreted as only being concerned with economy. Historical materialism is, however, not to be comprehended as only revealing a capitalist economical struggle. The relations of production do also constitute many aspects of culture, law, and other domains (Van Apeldoorn, 2004).

The traditional classroom is organized for optimizing surveillance and execution of control over the learning process in a mass educational setting. With its rows of benches, chalkboard and routines it is designed mostly for transmission of knowledge from the active teacher to the passive students (Cuban, 1986).

Using this comprehension, the classroom is a unit suitable to be placed on the foundational level of the historical materialism model since the classroom has a clear division between those who rule and those who are ruled.

In this analysis the model of historical materialism is applied with the educational system understood as the foundation (Figure 1). The forces of production encompass all parts of the educational system; ICTs, teachers and learners etc. What is produced is to be understood as learning.

Politically affiliated newspapers are parts of the superstructure as subordinates to the political institutions (Gramsci, 1999).

Historical materialism has been criticised for being deterministic. This analysis does not, however, measure societal development as whole. In this paper the theory is applied only to a small part of the society, during a short time. It is only the model that is applied in the analysis, not any other Marxist doctrine of the societal development.

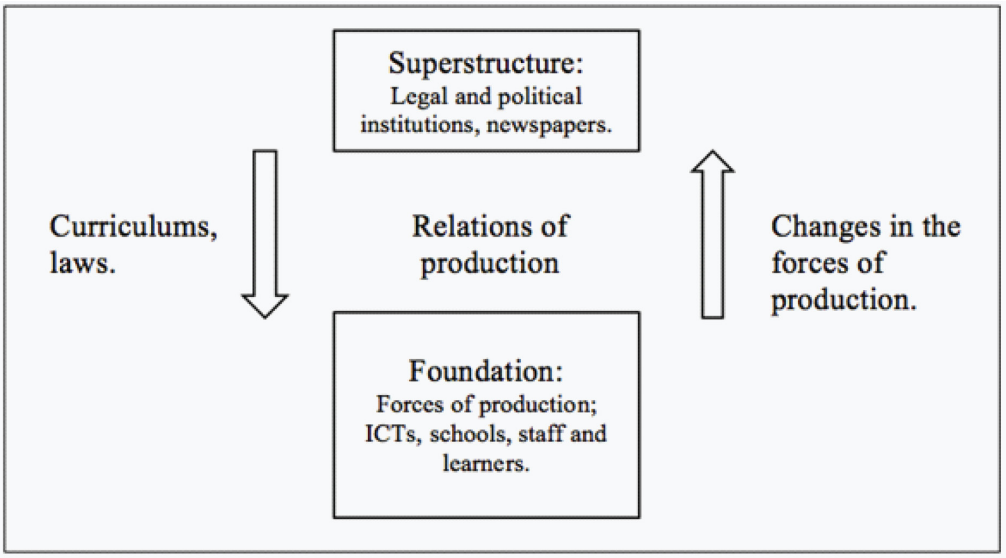
Historical materialism is applied as a theory for analysing the historic process of interest since it provides a model for comprehension of the reciprocal relationship of structure and action (Tosh, 2002; Van Apeldoorn, 2004).

USING NEWSPAPERS AS HISTORICAL SOURCES

Historical sources contain assorted information. What questions the historical material is addressing will decide what information the evidence will provide. This paper presents an analysis of sources originating from two Swedish newspapers, Aftonbladet (AB) and Dagens Nyheter (DN).

As sources, newspaper articles capture and reflect influential opinions in the debates of past times, political as well as public. They are principally written with a bias aimed to affect the opinion of their contemporary readers.

Figure 1. The historical materialist model as used in this paper



They do, however, stay within the boundaries of what is judged as suitable for public consumption (Tosh, 2011). Newspaper articles are not always valid in describing the past, but they are generally reliable (Franzosi, 1987; Tosh, 2011).

Newspaper articles do not give us the whole story, but if they are treated as remnants of the past they will provide a trustworthy insight into the nature of the debate. Using articles for judging public opinion might be uncertain, but the articles still reflect the opinions of the informants and the authors (Waller, 1961). The articles tell us about the ambitions of the politicians and about who is transmitting an opinion and when this is occurring. As mediators of news reports, debate and opinions newspapers can serve as documentations of actions taken in both the superstructure and the foundation. They do not, however, provide a complete depiction of the event.

Politics, federal laws and curriculums govern the educational system, and politicians are powerful actors in shaping these. In a democratic society politicians need voters. The press offer channels for transmitting messages and to shape public opinion. Gerber, Karlan, and Bergan (2006) point out that "even a short exposure to a daily newspaper influences voting behaviour as well as some public opinions" (p. 18,) but do not conclude whether it is the content of the articles or the political angle that is most influential.

Nevertheless, doubts could be raised about the impact of articles in newspapers on public opinion. In Sweden 80% of the press has been affiliated to the right wing while approximately 50% of the voters usually vote for the left (Wadbring, Weibull & Bergström, 2002). Even though newspapers are relevant for creating public opinion, they are not the unique contributing factor that matters.

The articles from the Swedish press, which are presented in this paper, mediate opinions on pupils' utilization of mobile phones in the Swedish school system. Many of these opinions derive from statements from politicians.

METHOD

The newspapers AB and DN were selected for several reasons. In order to avoid opinions of minorities, they are the two newspapers with the greatest circulation in Sweden; both of them

have their editorial offices in Stockholm, but they are covering the whole country; they also have different political affiliations.

The sources in the author's previous work (Ott, 2013) were collected in searches carried out in 2011. In this paper, the sources have been revised with the same method as was used in 2011 but the examination stretched further in time to the 31st of May 2013. Two searches were conducted in the online database Mediearkivet; one using the keywords "mobile phones" and "the school" and the other using the keywords "mobiles" and "the school". The result from the searches conducted in 2013 did not fully match the result from the searches in 2011. Some of the articles in the material presented in Ott (2013) did not reappear in the search made 2013. These articles did however exist, but in the searches conducted in 2013 the database did not respond to the same keywords in the articles. Since the articles were a part of the material in the earlier quantitative and qualitative examination they were also included in the revision. There was, however, not only a problem with articles lacking in the material, two more articles did additionally appear from the period 1996-2011 which the earlier searches did not provide. These have been included in the new material. The fact that articles did not reappear indicates that the reason for this has its origin in the programming of the database, rather than in a flaw in the research method. Together, the number of articles in the material adds up to 57 from AB and 56 from DN for the data reported in this paper.

The articles were selected out of a larger number of hits in the database on the basis of reporting directly about school or displaying content relevant to school, children and students. The articles were analysed regarding rhetoric and context: educational, pedagogical, political or other concepts addressing the utilization of mobile phones.

The articles were also chronologically quantified in order to identify any patterns in the dates of publication. Finally the explicit content and implicit messages in the articles were interpreted, analysed and regarded from the framework of historical materialism.

SOURCE CRITICISM

In a historical analysis the material must be validated with a method for source criticism. An evaluation of the sources from the perspectives of authenticity, dependence (whether the source is a remnant, a primary source or a secondary source), closeness in time and bias (Kjeldstadli, Persson, Åmark & Torhell, 1998) reveals the value of the sources.

The material under study was judged to be authentic on the basis that the articles often, but not always, were presented in two versions in the database, one text version and one depiction of the page from the newspaper. Those articles that were not found in the search of 2013 were located through reading the full newspaper from the specific date, which was known from the search of 2011.

Regarding dependence, the articles were remnants and parts of the debate. Distance in time between report and event was not a problem using the articles as remnants. As such they are parts of that past time in which they were created, and conclusions were possible to be made regarding that situation (Kjeldstadli, et al., 1998).

Since the aim was to identify opinions and ambitions, bias in the material is part of the result (Tosh, 2011). The newspapers providing the material under study were chosen on the basis of being affiliated to different political sides. AB is unaffiliated Social Democratic and DN is unaffiliated Liberal.

RESULTS

The results from the analysis of the sources are in this section organized and accounted for under several topics.

The beginning of a reactionary debate: describes the first period of the debate and what turned out to be the beginning of a generally

hostile discourse towards the use of mobile phones within the school system.

Politicization of the issue of mobile phones in school: describes how policymakers used the issue of eliminating mobile phone from schools as a stylistic means in their rhetoric.

Ownership of the mobile technology: describes issues of property rights regarding mobile phones.

The symbolic question in the debate: describes the connection between political events and the presence of statements on mobile phones in schools.

The road towards legislation: describes the political debate on schools in general and the period when the law giving teachers a clearer authorization to confiscate disturbing and dangerous objects was put in to effect.

A school not build on scientific principles: describes the Swedish school law.

Conceptions of the classroom and mobile phones: describes the traditional conceptualization of the classroom in relation to mobile learning.

Divergent conceptions of use: describes different opinions reflected in the debate on possible uses of mobile phones within the school system.

Different cultures of learning: describes the difference between youths and adults in how they regard mobile phones in school.

THE BEGINNING OF A REACTIONARY DEBATE

The sources examined in this paper were predominantly from the time after the IT-boom. The sources did not reflect the same trust in the technology as the sources used by Karlsohn (2009) did. In general the reports on utilization of mobile phones in schooling have focused on negative effects of the technology and on how to handle the destabilization of the formal learning context that was caused by mobile phones.

AB published the first article that reported on the use mobile phones in school in 1996. The article however reflected a positive spirit and could be understood as an expression mirroring the ICT-friendly climate in the society as a whole at that time. The article described a school in Stockholm where pupils from first class used the mobile phone as a modem to connect to the Internet when they were not in the classroom.

Given that Sweden was not to lag behind in international competition, many municipalities made ambitious ICT investments in their schools (Karlsohn, 2009), but at the same time new ICT started to appear that did not derive from governmental investments. These ICTs were the mobile phones. An article from AB in January 1998 can serve as the first of many examples (not all of which will be accounted for in this paper) of how the new technology's impact on education was reflected in the newspapers. The article reported from a secondary school that had decided to ban scruff, caps and mobile phones in order to cope with problems regarding rude behaviour and bad language. The connection between the problems at hand and the counteractions they led to was not further explained in the newspaper. However the article provides an indication that a transformation in the forces of production had started. This was a transformation that was not in control of the legal and political institutions. However, since the transformation challenged the relations of production then the superstructure had to react.

POLITICIZATION OF THE ISSUE OF MOBILE PHONES IN SCHOOL

Within the mobile learning field difficulties of merging mobile IT with curricular learning have been recognized. Sharples (2013) states that the two most promising areas of research to pinpoint are the use of mobile IT to support curricular learning in the classroom and personal learning on the move. This means that as the forces of production are challenged, they must be allowed to have impact on the relations of production, in this case on the rules for teaching and learning.

In the public debate these aspects were an exception, the debate was rather about how to eliminate mobile phones from the production of knowledge. This became evident when studying the material prior to the election to the parliament in 2002. At the time, questions concerning school and education were heavily debated and the number of articles published peaked for the first time. Profiling on school matters the Liberal Party's spokesmen Lars Leijonborg and Jan Björklund plead for order and discipline in the classrooms. The forces of production were not working as they should and disrupted the production of knowledge. On the 12th of January 2002 DN published a reportage from a school where the school administration had taken action. Mobile phones were supposed to be turned off or handed in to the school administration for the duration of the school day.

Soon, other politicians joined the debate. Bo Lundgren of the Moderate Party declared in DN on the 18th of August 2002 his support of the Liberal Party. He claimed that mobile phones implied a disturbance to the work environment in schools. In an interview in DN on the 1st of September 2002, Leijonborg stated the belief that people appreciated the Liberal Party's plain language on self-evident topics like not using mobile phones during class.

Different actors in the debate supported Leijonborg and sustained that the issue was self-evident. In fact no other points of view were found in the material prior to the election. The teachers active in the debate stated however that they could handle the problems with the use of mobile phones. They claimed that there were more serious problems to focus on regarding school. The staffs of the schools on the foundational level were, as these fragments of the debate reveal, affected by the turmoil in the superstructure. One head teacher opposed the Liberal Party in AB on the 8th of August 2002, when he claimed that the call for a ban was a disapproval of his professionalism.

The Social Democratic Secretary of Education Thomas Östros, in an opinion piece in AB two days prior to the election, partly joined with the Liberal Party's approach to the use of mobile phones in school and stated that it was not the self-evident questions like mobile phones being turned off in class that would determine the future of Sweden.

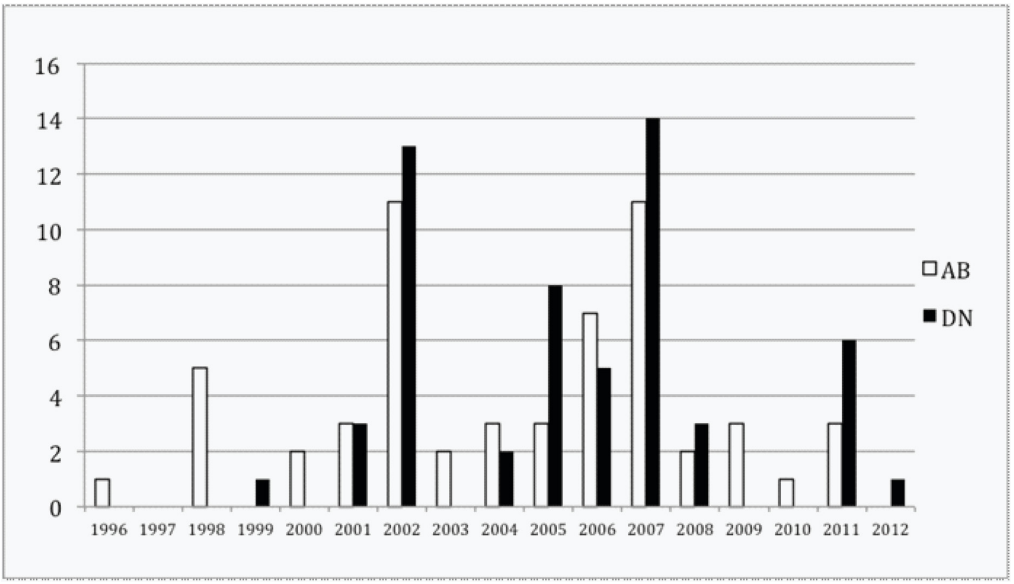
In the debate, both the left and right-wingers considered mobile phones as artefacts, which disrupted the production in school and grouped them together with what was often referred to as "other disturbing objects". What those objects were tended to vary, but a package of objects that caused disruption could be identified. The mobile phone was in the centre stage flanked by various objects of distortion, such as narcotics, sticks, videogames, fireworks, knives, mp3 players, caps, chewing gums etc.

The Social Democrats won the election. In Stockholm, Björklund was forced to resign from the municipal government as Commissioner of Schools, but in the whole of Sweden the Liberal Party did well, their share of voters increased from 4,6% to 13.3% (Valmyndigheten, n.d.). The historical evidence does not reveal which actual role the self-evident questions played in this inconsistent result of the election. An article in AB from the 4th of November 2003 analysed Leijonborg's accomplishment as Chairman of The Liberal Party. The effort to obtain a ban on mobile phones in schools was considered to have been an important ingredient in their package of political matters that concerned school and thus many people. However there were no arguments from politicians found in the examined material at that time opposing the Liberal Party's stand.

There were, however, two articles which deviated from the general pattern of opinions. They were published in AB on the 14th of November 2002 and on the 25th of January 2003. They reflected that in the foundational level, mobile phones continued to gain ground against the traditional formal education. The articles reported of a head teacher who claimed that the mobile phones were becoming essential tools in the education process at the school.

In the years 2002 and 2003 these two articles were nevertheless exceptions. In the material studied, mobile phones were generally not regarded as artefacts that could be of any

Figure 2. Number of articles published per year



use within a pedagogical context. Even the news articles had a bias, which was noticeably negative towards use of mobile phones in schools.

OWNERSHIP OF THE MOBILE TECHNOLOGY

The question of ownership of the technology is important in the historical materialist analysis, and it is a key factor for mobile learning. Drawing on conference papers from mLearn conferences between 2002-2005, Naismith and Corlett (2006) identified five crucial factors for operating a successful mobile learning project: access to technology; institutional support; connectivity; integration (with the curriculum, the students' real life experiences or the combination of these) and ownership (the student must feel that the technological artefact is their own or can be treated as their own).

Norris and Soloway (2010) stated that the mobile phone is a technological artefact, which is in the possession of students and which they bring to school. Between 1996 and 2002 the possession of mobile phones among Swedish households had increased from 50% to 87% (NORDICOM, n.d.). As new models have been marketed, older ones have been discarded or passed on from parents to their children (Bjärvall, 2011). Hence the number of mobile phones in possession of pupils in school gradually increased over the examined time interval, and so did the number of articles until the first peak in 2002 (Figure 2).

The question of ownership was also addressed in one letter to the editor in DN on the 7th of September 2002. Opposing the Liberal Party's quest for control of the forces of production, a reader raised the question whether Björklund had forgotten about property rights.

The debate also indicated that there were anxieties among students regarding their access to the technological artefacts in their possession. On the 27th of February 2005 four students were interviewed in AB. They expressed critical views towards a proposal for banning mobile phones and other beeping devices. They feared that the teachers would not be able to conduct an assessment of what was disturbing in a fair manner. Furthermore, in DN on March the 4th, Information Manager Suzanne Staaf of the Swedish student council said that confiscation

of mobile phones could be performed, but it had to be executed by the police or a prosecutor and not by a teacher. It was obvious, two other students being interviewed said, that students should not talk on the mobile phone during class; it was rude. If you got a call, you told the teacher and left the classroom. It was not a big deal.

To the students, ownership of the productive forces was not to be an exclusive right belonging to the educational institutions and the legislators.

THE SYMBOLIC QUESTION IN THE DEBATE

On the 5th of July 2005, an AB editorial stated that it was not a hazardous proposal to ban mobile phones. What was dangerous was that the question dominated the debate about school. In a similar statement in AB on the 27th of February 2005, Eva-Lis Preisz, Chairman of the teachers' unions, stated that the banning of mobile phones had become a symbolic question of importance.

It is evident from the correlation between the dates of the political events and the published material in the quantitative examination that mobile phones in schools have been regarded as an urgent question for the newspapers to address. In 2002 the number of articles on mobile phones in schools was peaking and in 2006 there was also a large number of articles published on the topic. In 1998, 2002, 2006 and 2010 there were elections to the parliament but in 2010 the topic generated very few articles compared to the other election years (Figure 2.).

The election in 2006 resulted in a shift of government. The Social Democratic government was replaced by the right wing coalition "The Alliance"[1]. After the second peak in 2007 the number of articles published per year was declining.

From the stakeholders' societal position and from their expressed opinions it is obvious that the superstructure was affected by the changes in the foundational level. Regardless of whether these changes were a threat to productivity or not, in the debate most politicians choose to confront them as if they were. However the transformations were not possible to be held back. Mobile phones were becoming more and more widespread.

THE ROAD TOWARDS LEGISLATION

Liedman (2011) discussed the school system from two perspectives, an inner and an outer appearance. Most people notice only the outer. In the public debate over the school system, it has been visualized as a chronic problem with youngsters terrorizing each other and their environment. In the Swedish policy debate this aspect has been combined with the story of declining results, foremost in mathematics and science. The governing policymakers have reached the conclusion that when students do not manage to comprehend the courses they will turn to disruptive behaviour. They start to talk in class and also use their mobile phones. This behaviour disturbs the more industrious students.

In the examined material this perspective was noticeable from the focus on the learning environment of the classroom, and how that environment was ruined by lack of order and discipline. Mobile phones were described as being used for calling, gaming, filming and loud speaking etc.

According to Liedman (2011) Björklund, Minister of Education (2007-present), has been at the centre stage of the debate. The other strong political power regarding school in Sweden, the Social Democratic party, initially opposed Björklund. Over time though they, with some differences, joined with Björklund on criticizing certain aspects of the educational system. The initiative in the debate is however with Björklund, and every opponent is an anomaly (ibid). The material studied did not contradict these views, as expressed by Liedman. In this study it turned out that in more than 50% of

the times a policymaker was mentioned it was Björklund.

In the parliamentary election of 2006 the right wing coalition prevailed and Leijonborg was appointed Minister of Education and Björklund was appointed Minister of Schools. On the 27th of October 2006 AB reported on the implementation of a new law, which would give teachers clearer authorization to confiscate disturbing objects. A teacher who was interviewed pointed out that the new law made him feel mistrusted as a professional. In a letter to the editorial in DN on the same day, another teacher, who claimed to have 30 years of experience, however expressed gratitude towards the Liberal Party and also appreciation of the new law. On the 31st of October 2006 Björklund was attacked in an article in AB, which claimed that banning mobile phones had been labelled as a drastic solution to an urgent problem, which was not the case.

On June 2nd 2007 AB reported on the new law, which provided teachers with the authorization to confiscate objects that caused a disturbance or a threat to the safety of the education. Those objects were such things as mobile phones and fireworks. The main body of articles from 2007 in the material studied were published prior to the 1st of July when the law took effect. There is however a noticeable change in the theme of the articles over the year. With the new law in waiting, most articles were portraying chaotic schools and claimed that disturbances depended on the use of mobile phones. After the law took effect, the focus shifted to the portraying of successful school environments, where local regulations had for a long time been banning the use of mobile phones in class.

In spite of the measures taken both by the government and by the newspapers the changes in the productive forces continued to put pressure on the superstructure. Soon even a slight change in the superstructure's attitude toward mobile phones in school could be noticed.

A SCHOOL NOT BUILD ON SCIENTIFIC PRINCIPLES

In addition to the abovementioned law from 2007 the Swedish government has since 2006 also passed a new school law and new curricula for preschool, school centres, elementary school, upper secondary school and adult education. In the Swedish school law from 2010 the Ministry of Education and Research states that: "The education shall rely upon scientific principles and proven experience" (Ubildningsdepartementet, 2010).

In 2011 a new curriculum was introduced for the Swedish school system. The Swedish national curriculum for elementary school, school centres and preschools states that the school is supposed to work together with the homes of the pupils, and to prepare them to live and act as citizens in the society. The pupils are supposed to be able to orient themselves in a complex reality with a high flow of information and change. Hence methods and strategies for learning and using new knowledge are important. For qualitative development of every school, the pedagogical leadership and the teachers must employ their professional responsibility. Every school must evaluate and try to develop new methods, and this should be done in interaction with the homes and the surrounding society (Skolverket, 2011). This could be an opportunity for the implementation of mobile phones into the forces of production.

According to the sources, eliminating mobile phones from education was, however, one of the Liberal Party's main questions during 2002. From the examined material no changes in their policy towards mobile phones were to be found. The Social Democrats did not oppose this stand. Banning mobile phones in the classroom are by most opinions regarded as a truism.

Prior to the parliamentary elections in 2006 and 2010 there was not as much focus as in 2002 on the issue about mobile phones in school. What differed between the pundits in the debate at the beginning of the period examined was that the Social Democrats plead for further

investigation to be done by the National Board of Education. Björklund on the other hand stated that it was no longer time to investigate; it was time for action.

The passing of the law, which gave teachers a clearer mandate to confiscate disturbing and dangerous objects, was reflected in the historical material by an increasing number of articles on the topic during 2007. Confiscating disturbing objects has probably always been allowed, but the articles in this study prove that the rules for this have not been perceived as clear enough.

The Department of Education and the Swedish School law, passed by Björklund and the right wing government, clearly state that education in the school system should rely on scientific principles and proven experience. There were however no references in the newspaper articles to results from scientific studies regarding use of mobile phones in school. Articles where politicians were either writing the texts or being the subject of the texts, often described a school where mobile phones were regarded as an outstanding problem. Björklund claimed that this was a comprehension deriving from the teachers, but when teachers were interviewed they stressed the importance of other problems. Teachers were not asking for a ban on mobile phones in school, but not for use of them either. The use of mobile phones was not the big issue; pupils knew when they should turn them off. This is worth noting since those who have the proven experience expressed in the school law must be the teachers. Consequently the message carried out did not, as the school law demands, rely upon scientific principles or proven experience. It has been something else that caused them to take action on mobile phones.

CONCEPTIONS OF THE CLASSROOM AND MOBILE PHONES

Liedman (2011) asked what the aim of the educational system really is. Should school be a counterforce to society, or should it provide a model of the society in which the children eventually will live and act?

This is a conflict which also is acknowledged internationally: "It is an increasingly accepted truth that education systems must evolve to meet the needs of the students and societies they serve, changing their mission from knowledge transmission to preparation for future learning" (Shear, Gallagher, & Patel, 2011, p. 11).

There is a gap between what the students experience and learn inside the classroom and what they need in life. What Shear, Gallagher & Patel point out is the necessity for education systems to aim at the process of learning, rather than at a product of learning.

New technologies may help learners in the process of learning, thus opening up the classroom and enabling new ways of communication and cooperation (Säljö, Jakobsson, Lilja, Mäkitalo, & Åberg, 2011). Reaching out from the formal classroom has been regarded as one of the major benefits of mobile learning. Learning can take place whenever a person has to find a solution to a problem. The learner can make use of all available resources; teachers, affordances in the environment, technologies etc. The context is dynamically constructed when the learner is interacting with the environment (Kukulska-Hulme et al., 2009; Sharples, Taylor, & Vavoula, 2005).

Using mobile technologies for learning in the intricate mixture of informal and formal learning (Malcolm, Hodkinson, & Colley, 2003) opens up the classroom. The interrelationships between formal and informal learning are important to examine in a wider context. This is particularly important, considering empowerment and oppression (Malcolm et al., 2003). Kukulska-Hulme (2006) stressed the importance of how to appreciate the technology; does it only denote amusement or insinuate something else? In addition Sharples (2006) stated that schools have failed to recognize the informal networked learning processes that are mediated by pupils' own mobile phones or computers.

Mobile technology, when in personal ownership of students, can however be both

motivating and disruptive (Sharples, 2013). This could nevertheless result in learning that is more relevant to the students and at the same time can be economically justified (Norris & Soloway, 2010).

If the classroom is considered as the situated locality where learning is supposed to take place, then mobile learning could be somewhat of an evasive matter. Mobility is spatial, but also temporal and contextual (Kakihara & Sørensen, 2002). A school fixed in time, relying on place and context (lessons, classrooms and subject curriculums) will encounter conflicts with learning grounded in mobility.

The material in this study reflected these conflicts. Even though the politicians or other voices occurring in the debate did not mention it, the debate on mobile phones in the examined sources has been a kind of behaviouristic striving to eliminate utilization of a technology that is regarded as creating a disturbing behaviour in the traditional classroom setting as described by Cuban (1986).

This is, however, not a recently discovered conflict. Mobile phones might just be the latest technology in a long line to put pressure for change on the educational system. Cuban's analysis from 1986 described how film, radio and TV, even though highly promoted by enthusiasts outside of school, failed to transform the habits of teaching and learning in schools. Technologies did not solve the problems teachers experienced (Cuban, 1986). This time, however, the challenge of the school system did not come from the superstructure, but from the foundational level, and as the technology developed and became equipped with more functions, multiple new malfunctions in the forces of production were reported in the newspapers.

DIVERGENT CONCEPTIONS OF USE

If mobile phones are predominantly regarded as mediators of disruption, and if educational institutions do not support the use of them, appropriate applications will be difficult to develop. Similar opinions were expressed by some voices in the debate that argued that the disturbances were being caused more by misuses than caused by the technology itself. DN published an example of this on March the 31st, 2001. A head teacher was quoted to have stated that prohibition would be the wrong way to go. He pointed out that school should rather teach students how to use their mobile phones.

In two articles from 2008, again possible uses of mobile phones in school were proposed. In relation to the mobile learning research the suggested uses in the newspapers reveal a difference in the acknowledged potential of the technology. An article in DN published on the 20th of February gave an account from a school where pupils were being allowed to use their mobile phones for calculating and listening to music as long as it did not disrupt the work environment of the classroom. On the 24th of September AB reported of a possible disciplinary use of the mobile phones in a school context. Parents could receive a text message from the school when their child was found to be skipping class. The suggested uses are in these articles focused on learning within the context of the traditional classroom.

In AB on the 5th of December 2009 a noteworthy anomaly in the debate occurred. Member of Parliament for the Moderate Party Oskar Öholm, was reported stating that as being parts of our society, mobile phones should be used in school too. This article indicates that in the superstructure it had become more difficult to resist the pressure from the foundational level. On the contrary the other articles in the material originating from this year were reporting about radiation from mobile phones causing brain tumours and also about how the successful law for confiscating mobile phones had been generating peace and a good environment for learning in school. In 2011 there was a noticeable divide in the attitudes within the superstructure regarding the question about how to deal with the changes in the forces of production. Should action be taken for reformation or confrontation?

On January the 25th 2011, Erik Bengtzboe of the Moderate Party's Youth argued in an opinion piece in AB that the debate should not be about seizure of mobile phones, but rather about how to learn with the help of them and what to learn from them. He stated that school must be better at using the modern technologies,

Furthermore DN on the 26th of April 2011 published a report with the headline: "What is important is what the teacher does with the technology" (Dagens Nyheter, 2011). It reported from a school in Lesotho. The teacher Moliehi Sekese was quoted saying that as a teacher you must have a plan for the creative usage of the technological tools in education. The mobile phone was one of the technological artefacts that Sekese was described using.

On the other side of the gap of opinions there were five other articles from 2011 that were clearly hostile towards usage of mobile phones in school. The Minister of Health and Social Affairs and Chairman of the right wing party the Christian Democrats Göran Hägglund, on the 4th of November 2011 in an opinion piece in DN, called for more authoritarian teachers seizing mobile phones in class.

Of the two new articles trawled up in the 2013 search one was published by AB on the 29th of December 2011. It was a letter to the editor from a twelve year old girl. She expressed her beliefs that you do not learn better not wearing a hat. It was rude to text or surf the Internet using the mobile phone during class, but it was also a useful tool for searching the Internet in education, for example when working on projects. For her, the mobile phone was an accepted force of production.

DIFFERENT CULTURES FOR LEARNING

In resemblance to the historical materialistic model, Sharples (2006) identified two systems in school; one stands for the youth culture with mobile technology and social networking. This culture is more or less impenetrable to adults. The other represents the formal school with its curriculum and teachers. They are deciding the acceptable discourse, and technology. Mobile IT, including the possibilities it creates with social networking and collaboration, is part of the youths' culture. Maybe the tensions which spring into existence in the classroom could be more easily moderated if interpreted as the consequences of two clashing systems rather than individual confrontations.

There were examples of these clashing systems reflected in the debate. A questionnaire was published in AB on January the 23rd 2004. Five people were asked whether they supported a ban on mobile phones in schools. Three of them (the youngest of them was 39 years old) were affirmative. One older man did not support a ban, but stated that the mobile phone should be turned off during class. The fifth person, a nineteen year old adolescent said no, a ban would not help. Students were too accustomed to using mobile phones. AB published an almost similar note, interviewing five people on the 28th of October 2006. This time the youngest respondent was thirty years old. The respondents were all in support of banning mobile phones in school. The questionnaires were not representative statistically, but are worth noticing since they indicate what was judged as being suitable to publish.

From 2010 there were no articles in the search conducted in 2011. However in the search of 2013 an opinion piece turned up from AB from the 5th of September. Bert Stålhammar, Professor Emeritus in pedagogy, stated that there were obvious problems with bad manners in schools. Caps, jackets, chewing gum and mobile phones were part of these. However these artefacts are also part of the youth culture.

As members of the younger cohort heard in the debate, Öholm (born 1980) and Bengtzboe (born 1987), expressed an urge for a more appropriate understanding of the potential of the technology.

Kukulska-Hulme (2006) and Thomas and Brown (2011) envisioned possibilities for a new culture of learning, where students are connected and learn together and from each other in various networks, communities and

collectives. This new culture and the traditional formal classroom education may coexist and complement each other. This is also what Sharples (2013) concluded.

One of the technologies to be mastered by teachers and students has, though, come in conflict with the formal education and the established opinion of what learning and school will aim at, the teacher's agenda and the curriculum (Sharples et al., 2005; Traxler, 2007). That technology has at its centre stage one specific artefact, the mobile phone.

CONCLUSION

From a historical materialist perspective, the debate over mobile phones in the two newspapers has been a consequence of a struggle for control of the knowledge production in the school system. This conclusion could be drawn from the stakeholders' societal positions and from their statements. One of the things that made mobile phones in school settings controversial was that they were not in the possession of the learning institution, nor in the control of the legislators.

Little regards has been taken in the debate of the opinions of teachers and pupils. Neither has any regard in the debate been taken to mobile learning research. In the debate most politicians have regarded eliminating mobile phones from schools as a common will.

When mobile phones began to appear in the school system a change of the forces of production started. However, instead of using their governing power to integrate the mobile phones into the forces of production, the reaction from the political and legal institutions and from the newspapers has been a struggle to eliminate them. That has been an unsuccessful quest; mobile phones in school are addressed in almost a similar manner throughout the examined period.

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ENDNOTES

[1] The Alliance (Alliansen) is the name of the political coalition consisting of the Centre Party (Centerpartiet), the Christian Democrats (Kristdemokraterna), the Liberal Party (Folkpartiet) and the Moderate Party (Moderatera samlingspartiet).

ARTICLE 2

STUDENTS' USE OF MOBILE PHONES FOR SCHOOLWORK

Ott, T., Haglind, T., & Lindström, B. (2014, 3-5 November 2014)
In: M. Kalz, Y. Bayyurt, & M. Specht (Eds.). *Mobile as mainstream—towards future challenges in mobile learning: 13th World Conference on Mobile and Contextual Learning, mLearn 2014 Istanbul, Turkey, November 3–5, 2014, proceedings* (pp. 69–80). Istanbul, Turkey: mLearn 2014

Students' Use of Mobile Phones for School Work

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Abstract

Findings from a student survey at a Swedish upper secondary school class concerning the use of mobile phones for school work are presented in this paper. A previous study indicated that a majority of the students did not regard the mobile phone as a suitable tool for school work at school. However 56% of the students stated that they used mobile phone for school work at home every week (Haglind, 2013). In relation to the previous study this paper explores the students' perception of the mobile phone as a tool for school work in school and the students' use of it for learning at home. The results indicate that the mobile phone can be described as a boundary object between the students' social worlds of home and of school. The results also show that the students use their mobile phones for school work related tasks, when the task is suitable for the mobile phone format.

Keywords

Boundary objects, mobile phone, school work, usage, 1:1, upper secondary school.

Introduction

Our modern way of life is highly dependent on connected technologies and activities mediated by those technologies e.g. laptop computers, tablets and mobile phones This affects several layers of the society including school (OECD 2012).

In Sweden, like in many other countries, several schools are 1:1 schools. In a report to the Swedish Municipalities and County Councils Hylén (2013) states that many municipalities have on going or are planning 1:1 projects. This means that the school equips every student with a digital tool, often a laptop or a tablet. However, the devices provided by the school, are not the only technology students have at hand. Today most students also have a mobile phone in their possession (Norris and Soloway 2010). In Sweden in 2013, ninety-nine percent of the population in the age span 15-24 years in their homes had access to some kind of mobile phone. Ninety percent had access to smartphones (NORDICOM n.d.). Throughout the society outside of school mobile phones are important tools for communication. In school the use of mobile phones are more scarce. Students' use and even possession of mobile phones in classroom context is contested (Ott 2014). However, as a report from European

Commission (2013) concludes, students bring their mobile phones to school no matter if the school supports a use or a ban of mobile phones.

The question might not be *if* but *how* mobile phones are to be used for learning in school. "[...] we may feel that mobile learning is no longer an innovation within institutional learning but a reflection of the world in which institutional learning takes place" (Traxler and Vosloo 2014). It is then interesting to find out more about how students use of their private mobile phones for school work at home. It can be uses that might spill over to the school work in school. The students might be used to tackle problems in certain ways that involve usage of mobile phones. It might also be that the students have competences on using mobile phones for problem solving. These habits and competences are not left at home when entering school. This paper reports of a small-scale study of this issue, conducted in a 1:1 learning environment.

Problem Area

The problem presented in this paper originates from different ways to perceive various modern technologies as tools for learning. Technologies like mobile phones, laptops and tablets are mobile, connected and personal. These devices can be utilized for learning when moving between formal and informal learning settings, in and out of school, and between various communities (Chan et al. 2006). Mobile learning as an approach to learning entails learning mediated by mobile technologies, making the learner mobile (Sharples et al. 2007). Mobility can be understood as temporal, spatial and contextual (Kakihari and Sørensen 2002). One of the two most active areas of research within the field of mobile learning at present is the use of portable devices to support the curricular learning (Sharples, 2013). Mobile technologies, e.g. mobile phones, are now ubiquitous in most parts of the society including school (Norris and Soloway 2010). According to O´Bannon and Thomas (2014) mobile phones can support creativity, collaboration, connectivity, reflection and instruction in the classroom. But there are also hindrances to mobile phone usage in the classroom e.g. disruption, cheating, texting, sexting, cyber bullying and poor technological infrastructure (ibid). And there are many factors affecting the learning outcome, for example learners' motivation and attitudes towards using technologies; their skills in using technologies; access to technologies; and the nature of technological use (Adhikari et al. 2012). When it comes to the nature of technological use, use in informal settings – in students' everyday life in non-schooling context – is different from use in formal educational settings.

Mobile phones typically do not belong to curricular activities. They are predominantly tools used in non-curricular and private activities. Although students appreciate some benefits of technology for making their school work more productive, they do not expect a teaching radically changed by technology. However OECD (2012) suggests this could change, if the experiences of using technology are more rewarding.

In order to understand the premises for using mobile phones as tools for school work it might be productive to consider the boundaries between school and non-school activities and mobile phones as boundary objects (Akkerman and Bakker,

2011; Star, 2012). Students in school can be regarded collectively or as individuals. They are brought together in various constellations by school activities and by school organization. They may share repertoire and may have a mutual engagement when collaborating, but they are their own enterprises. Their success or failure is personal. Phelan et al. (1991) suggest that students are participating in several social worlds with stronger or weaker boundaries between them. These worlds can be family, school, and peers. Students have to handle and to move between these social worlds, which do not always share a common ground of values and norms. Akkerman and Bakker (2011) state that all learning involves boundaries.

Students develop different levels of competence in crossing boundaries between different social worlds. The competence is of importance for the students' ability to use the school system as stepping stone for a successful life (Phelan et al. 1991).

Boundaries are comprised by sameness and continuity as well as socio cultural differences that generate discontinuity in action and interaction (Akkerman and Bakker 2011). The boundary entails a shared space where the sense of the own and the others' practices are being mixed up (Star 2010).

Crossing into and over the boundaries could be done either by brokering, people who transfer elements of different practices between practices, or by boundary objects (Wenger 1998). The boundary objects are objects of interpretive flexibility and objects of action. A boundary object resides between social worlds where it is poor structured. It is an object that is perceived more as private than as shared. Further it is an object that in the absence of consensus between the cooperating groups causes the subjects to wobble between the local and shared perception of the object (Star, 2012).

There is a contradictory relation between an interpretive flexibility and common recognition, "[...] boundary objects have different meanings in different social worlds but at the same time have a structure that is common enough to make them recognizable across these worlds" (Akkerman and Bakker 2011, pp.140-141). Boundary objects have a strong structure in their own social world. In the boundary the structure is weak. If a strong common structure is developed around the object, it is no longer a boundary object.

In 2013 students at the upper secondary school in focus of this paper answered a survey about use of Chromebooks and ICT in school and out of school. In the survey 56% of the students stated they use their mobile phone for *school work at home* at least once a week or more often (Haglind 2014). When the students were asked to rank how they appreciated different technologies in relation to their *functionality regarding school work*, mobile phones (Android and iPhone Smartphones) were by most respondents not regarded as a suitable alternative (Haglind 2013).

In group interviews carried out in connection to the survey of 2013 the students expressed that they did not think of it as a good idea to let them use their own technology in school (Haglind 2013). Subsequently there is a contradiction between the students' use of mobile phone for school work at home at their perception of it as a suitable tool to be used for school work in school. The study presented in this paper intends to focus the ambiguity by unpacking the perceptions of the tool. In this paper we connect this ambiguity to the crossing into the boundaries between different social worlds. The boundary for the students resides in the area where social world of school

and social world of the home are confounded. Certain tools can be linked to that area as being boundary objects. The objects both bridge and separate the social worlds. We identify the mobile phone as being one such object. How this is enacted in the group of students is what we examine. The relationship between the students' use of the mobile phone for school work at home and their perceptions of school work related use of mobile phones in school is in focus.

Method

A survey was distributed to a upper secondary school class in the Business Management and Economics program in a Swedish midsized city. Several studies regarding 1:1 initiatives in Sweden have been conducted during the past years (Grönlund et al. 2011 & 2013, Håkansson Lindqvist 2013, Samuelsson 2014).

The school in this paper is one of four upper secondary schools that have been subject of a larger study. The study is an evaluation of an on going 1:1 initiative, conducted over two years in the municipality. The evaluation indicates that the implementation of ICT in the municipality share common features with the utilization of ICT in other Swedish municipalities. ICTs are mainly use for utilization of the LMS, for writing texts, for seeking information, for taking notes and for communication. The evaluation in which the school in this paper were part indicates that the school does not deviate from the other schools and can be considered an ordinary Swedish school (Player-Koro et al. 2014a).

The school has both vocational program and preparatory program for higher education. The study was conducted at the Business Management and Economics Program and this program is a preparatory program for higher education. The survey involved one school class of thirty-one students in their first year at the upper secondary school. The class can be considered as being a quite regular class.

To reach an extended understanding of the ambiguous results of the 2013 survey (Haglind 2013) a second data collection was carried out in 2014 with the same students. In the 2014 survey the students were asked questions about their use of mobile phones for school work. The small sample size of the study raises questions concerning the conclusions that can be drawn from the data and about generalization of the results. However, since the study presented in this paper is carried out within a larger study of an ongoing 1:1 initiative, we argue that our data add important information on students' use of ICT for school work.

The survey was distributed in the classroom during a lesson and answered on paper with a pen. Twenty-eight students of which fourteen were males and fourteen were females answered the survey. The results were analysed with SPSS software. The questions in the survey were:

1. Are you a male or a female?
2. Do you own a mobile phone, if so what kind; a smartphone or a regular mobile phone?
3. Do you carry your mobile phones with you to school every day?

4. Regarding digital technology, what of a user are you; beginner, normal, habituate or expert?

5. Below there are a number of activities listed where you use the mobile phone for school work at home. Specify how often these activities occur in your school work? (for the categories see table 1).

6. What do you think is suitable areas of use of the mobile phone for schoolwork in school? (for categories see table 2).

7. What obstacles do you experience for using the mobile phone for school work in school?

8. How would you like to use the mobile phone for the school work in school?

Question one, two, three and four were background variables and question five, six, seven and eight were analysed in relation to these. Studying frequency levels and comparing different users groups by chi Square-tests and correlations did the analysis of question five. Question six were analysed studying frequency levels. Question seven and eight were qualitative questions and answered in text by the students. These answers were analysed and categorized based on their content.

Gathering data for the evaluation in Player-Koro et al. (2014a) a survey was distributed to the upper secondary teachers in the municipality's schools during the spring of 2013. One of the questions the teachers were to answer was to what extent they allowed students to use their mobile phones in their lessons. From the teacher survey, the teachers in the Business Management and Economics Program at the current school could be sorted out. On the Likert scale value 1 was not at all and value 5 was to a very high extent. Six teachers on the Business Management and Economics Program answered the question and the mean value was 1,83. The teachers on the Business Management and Economics Program at the school were not particularly allowing of mobile phones in their lessons. However this does not mean that they were negative to using ICT in their instruction. Results from the 2013 survey (Haglind 2013) show that a majority of the teachers teaching the class have a positive attitude towards ICT.

Results

In the responses twenty-six students stated that they owned a smartphone and two owned a regular mobile phone. All of the students stated that they brought their mobile phones to school every day. Twelve students regarded themselves as expert users, twelve regarded themselves as habituate users and four regarded themselves as normal users. No student did choose the lowest user category *beginner*.

Answering the survey all of the students stated that they use the mobile phone for school work at home for some purpose at least once a month. *Ninety-three percent* of the students stated they use it for school work at home *weekly*. Of them sixty-one percent use it more than three times a week. Thirty-two percent use the mobile phone for school work at home 1-3 times a week.

Table 1 presents the statistics of the students' answers to the question regarding which their uses of the mobile phones for school work at home are.

Table 1. Percentage of students' use of mobile phones for school work at home

	Never	At least once a month	1-3 times/ week	3 times/ week<	Daily
I cooperate with my classmates by texting	11	50	25	0	14
I cooperate with my classmates by talk or video calls	54	25	7	11	4
I cooperate with my classmates by social media	11	47	25	14	4
I communicate with my teachers	61	32	4	4	0
I use the mobile phone to access the LMS	43	29	21	0	7
I browse the Internet for information	21	11	32	18	18
I take pictures for school assignments	36	29	29	0	7
I revise lesson notes	50	21	25	0	4
I look at pictures	26	30	22	0	22
I record audio and video	61	29	0	4	7
I edit audio and video	64	14	4	7	11
I use the mobile phone to connect the computer to the Internet	39	50	11	0	0
I watch informational films on the Internet	61	39	0	0	0
I watch material produced by the teacher	55	30	7	4	4
I write texts for school assignments	78	11	4	7	0
I use the mobile phone as calculator	4	11	52	30	4
I use the mobile phone for translation of words.	11	11	53	18	7

The most common uses among the whole class were cooperation with the classmates by texting; cooperation with the classmates by social media; browsing the Internet for information; looking at pictures; calculation; and translation of words.

Regarding the relations between the students' perceptions of their user types chi square-tests indicated that between the expert user group and the group of normal and habituate users the only significant (p=0,015) difference found concerned the students' use the mobile phone to access the LMS. It was more common among the expert users. The correlation's strength were measured by Cramer's V = 0,458 (p=0,015). Which is a quite strong correlation.

Another matter of interest is what students' appreciation of the mobile phone as a tool for school work in school are. The students were asked to consider various uses and decide on one of two alternatives, suitable or not suitable. Table 2 display the percentage of students stating a particular type of suitable use of the mobile phone. Values <50% are highlighted in grey.

Table 2. Students' appreciations of the mobile phone as an appropriate suitable tool for school work in school.

	N&H* N16 % Positive	**Exp** N12 % Positive**	**All % Positive**
For cooperation with my classmates by texting	88	67	79
For cooperation with my classmates by talk or video calls	69	42	57
For cooperation with my classmates by social media	88	58	75
For communication with my teachers	69	33	54

To access the LMS	69	75	71
For browsing the Internet for information	88	92	89
For taking pictures for school assignments	88	92	89
For revision of lesson notes	50	50	50
For looking at pictures	75	75	75
For recording audio and video	81	75	79
For editing audio and video	63	25	46
To connect the computer to the Internet	63	58	61
For watching informational films on the Internet	56	42	50
For watching material produced by the teacher	50	42	46
For writing texts for school assignments	38	17	29
For calculation	100	100	100
For translation of words.	81	100	84

*Category N&H is Normal & Habituate users **Category Exp is Expert users

Table 2 indicates that in school the students regard the mobile phones as a suitable tool for most uses except for revising lesson notes, watching material produced by the teacher and for writing school assignments. The usage areas that the students find most suitable to use the mobile phone for (table 2) share many similarities to those uses that got the highest scores in table 1. The uses the students do most at home are also uses that the students regard the mobile phone as a suitable tool for in school e.g. for browsing the Internet for information; for calculation and translation of words; for cooperation with the classmates by texting and by social media; for looking at pictures and for taking photos for school assignments.

In comparison between the expert users and the normal and habituate users a difference in the estimation of suitable uses of mobile phones for school work in school is revealed. The students that classify themselves as expert users tend to be more sceptical than the group of normal and habituate users.

Another question is what obstacles for using mobile phones for school work in school the students identify. Analysing the data, four themes of obstacles could be identified from the students' answers; size, cheating, teachers and distraction. Some students identified several obstacles.

Table 3. Four identified themes of obstacles

Theme	Number	Quotation
Size	11(28)	"It is too small. It is more flexible and faster to use a computer. Also the mobile phone has smaller screen (S22)"
Cheating	6(28)	"Cheating. If there is a test you can use information on the phone and check. […] (S10)."
Teachers	6(28)	"That teachers do not want the mobile phone to be used during lesson (S23)".
Distraction	6(28)	"Distractions for most (S26)".

Noteworthy is that the students tend to state *cheating* and *teachers* separate. The two words do not always occur together in the students' answers.

Having identified obstacles for utilization of mobile phones for school work in school it is also of interest to investigate what uses of mobile phones for school work in school the students might desire. Some desirable usage areas mentioned by the students were; for calculation (7/28), for browsing information (5/28), for translation of words (4/28), for communication (3/28) as a calendar and for taking pictures (3/28). 13/28 of the students however stated that they either do not know, or that they do not want to use their mobile phone for school work. The reason why is because they have a computer. This is exemplified with the following two answers from the survey: "Rather not, prefer using the computer, there you have a bigger screen and it is easier to have several tabs", and "Ideally nothing, since it is my private thing. But it facilitates little now and then. Boring when you have to share your Internet".

Discussion

The results presented indicate that the mobile phone is not explicitly accepted as a tool for school work, but yet the students use it for school work at home. All of the students bring their mobile phones to school every day. But from the students' answers regarding desirable usage areas and obstacles for using the mobile phones we can assume that the mobile phone is not an integrated tool for school work in school. The results reveal that the mobile phones in the class examined is sharing characteristics with the concept of boundary objects as defined by Star (2010). The boundary objects are unstable and ill structured in the boundaries. Crossing the boundaries is done, but it is not done without hesitation. The school work related areas and purposes the students find the mobile phone suitable for in school are also the areas in which they tend to use them at home.

The students identify several barriers for their use of the mobile phone for school work. The students that describe themselves as expert users are more restrictive and selective regarding suitable school work usage areas of the mobile phone. It might be that the more demanding the use of the mobile phone is, the more evident are its shortcomings.13/28 students stated that they did not know what to do with the mobile phone, or that they did not want to use it for school work. Plausible explanations for this could relate to how school tasks are constructed; how the students are used to solve tasks in school and the students' teachers attitudes for using the mobile phone for school work. One student stated that the mobile phone was a private thing. Yet the students use their mobile phones for school work at home. Mobile phones are ubiquitous in society. Access to mobile phones in the age group is high. The data indicates that for solving problems at home the students develop certain strategies that involve mobile phones. The students do however not fully acknowledge these strategies as competences that could be of use in school.

The mobile phone is crossing the boundaries between the social world of home and the social world of school. The students do not in unison perceive the mobile phone as a tool desirable to utilize for school work. Quite a few of the students claim that they

do not know what to use the mobile phone for, or that they do not want to the mobile phone for school work in school. Still they do however bring the mobile phone to school and identify several possible school work related usage areas. Moving into the curricular social world of school the mobile phones is not left in the social world of home. There are boundaries between the social worlds where the students as members of different social worlds access the mobile phone. The students construct the mobile phone as a boundary object.

They also regard the computer as a better tool in school. Most of the students regard the mobile phone as a compliment but not as a substitute to the computer.

The limitations that the students experience with the mobile phones could be grouped into four categories: Limitations in the devices; perceptions of the devices; distraction and the nature of school work in relation to the potential of the device.

When the students in the survey of 2013 are asked whether they think that the mobile phone is a suitable tool for school work, many of them answer no. But when "unpacking" the question and asking them about specific range of use, we see another pattern in the answers. Student are answering in positive terms when presented with specific uses.

1:1 studies show that student use their laptop computers in school most for writing texts, taking notes and downloading material from the LMS (Skolverket 2013). These are uses difficult to do on a mobile phone. Some tasks are more convenient to use the computer for (write texts, take lessons notes, download big files) and some things are easier to do with the mobile phone (e.g. taking pictures, recording audio, and to communicate). Both technologies can be regarded as mobile devices, but they have different interfaces supporting different uses.

Player-Koro et al. (2014b) show that although a school has integrated a new digital tool this does not have to mean that the way of organizing school has changed. In their study, the way schooling is carried out is still to be considered traditional. Noteworthy is that even though the school might be traditional students answering the survey identifies uses supporting collaboration and communication in school. For tasks such as writing texts for school assignments, the students do not find the mobile phone a suitable tool. But for other tasks the digital development has changed its conditions, e.g information seeking.

Students generally expect their education to be traditional, but they appreciate technology if it enhances their productivity OECD (2012). To the students it is not rational to use a highly mobile device to solve traditional tasks designed to be performed sitting in the classroom. In accordance with O'Bannon and Thomas (2014) the results indicate that there are both benefits and barriers for using mobile phones in school. The results show that all of the students use their mobile phones at home for school work related usage areas that they think the devices can handle; cooperation with the classmates by texting, cooperation with the classmate by social media, browsing the Internet for information, looking at pictures, using the mobile phone as a calendar, using the mobile phone for translation of words and calculation. A lower frequency of use at home is reported concerning activities that the students do not think the mobile phones is a proper tool for. There is also a lower frequency of use in usage areas that the mobile phone could be a proper tool for; recording audio and

video and to some extent taking pictures for school assignments. These areas of usage coincides with activities that the students state that they also seldom use their Chromebook for (Haglind 2013).

Table 3 presented students' open text answers regarding barriers for use of mobile phones in school. The students make a distinction between the action of cheating and the prosecution of cheating in their answers represented by the teacher. Through focus group interviews this could be interesting to further investigate from a perspective of inner or outer motivation in mobile learning.

Boundary objects are unstable and the mobile phone is mainly residing in the social world of home. Future research will have to examine whether it will remain a boundary object or if school is strong enough to annex the mobile phone into its digital toolbox.

The students' usage of their mobile phones for school work at home is dependent on the task. If solving of the task benefits from the use of the mobile phone the students see no hindrance for using it.

From the two surveys the picture that arise from the questions concerning mobile phones and school work are ambiguity. We explain that ambiguity with the mobile phone being a boundary object between the students' social world of home and students' social world in school, at least concerning school work. The students use the mobile phone for school work at home, they identify several usage areas for which the mobile phone could be a suitable tool, still they identify severe hindrances.

To get a deeper understanding of the problem area it would be preferable to do further research. It would be valuable to have the students define school work, school tasks and their uses of the mobile phone for learning in school.

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ARTICLE 3

UNINTENTIONAL INTEGRATION OF TECHNOLOGY

TEACHERS' ATTITUDE AND PERMISSION OF MOBILE PHONES AS LEARNING TOOLS IN THE CLASSROOM

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Manuscript in preparation

UNINTENTIONAL INTEGRATION OF TECHNOLOGY
TEACHERS' ATTITUDE AND PERMISSION OF MOBILE PHONES AS LEARNING TOOLS IN THE CLASSROOM

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Abstract

Nations and schools have chosen different strategies to cope with mobile phones in the classroom. Policies for banning mobile phones have been common. In practice, it comes down to the teacher to enforce policies or permit students to use their mobile phones. We understand the integration of mobile phones into the classroom practice as a development of the infrastructure for learning. This paper reports on a survey of 210 Swedish upper secondary teachers' implicit or explicit permission of students' use of mobile phones during lessons. Our results show that even though there

has been little intention from the teachers to integrate mobile phones into practice, students are permitted to use mobile phones for a number of school work related activities. Hence, mobile phones are becoming tools in the infrastructure for learning that school practice relies upon.

Keywords
Beliefs, mobile phones, permission, upper secondary education, teachers.

1 Introduction

Digital technologies pervade society to the extent that we now talk about *digitalisation* of almost all aspects of society. Digital technologies and networking permeate working life as well as everyday practices of virtually everyone. And to most people, mobile phones are now more or less ubiquitously available. For example, approximately 100% of the Swedish youth in upper secondary school have in their possession a smartphone (Alexanderson & Davidsson, 2016).

Educational practices are also in change. Usage of digital technologies or information- and communication technologies (ICT), with the intention to support learning processes, are generally common in schools today. During the last decade, many countries have implemented so called one-to-one projects and programs where schools build extended technical infrastructures and provide students – and teachers – with a personal laptop or tablet (Tallvid, 2015). This goes hand in hand with digitalisation of administrative routines and processes in schools, similar to what is going on in other parts of society. The reasons for this are multifold: For example, to make education more effective; to reach more learners; to educate for the digital society; and, not the least, to enhance instruction and learning in traditional subject matter areas.

One-to-one projects can be seen as attempts to digitalise schools´ *infrastructure for learning* (Guribye & Lindström, 2009). An infrastructure for learning is "a set of resources and arrangements – social, institutional, technical – that are designed to and/or assigned to support a learning practice". (ibid, p. 112). Taking an *infrastructural perspective* (Bygholm & Nyvang, 2009) implies first of all a focus on the interconnections between social, institutional and technical resources. Second, it implies a relational,

ecological and layered view on technology use and integration. Thirdly, infrastructures are not fixed entities, but established in (local) practice; Fourth, infrastructures are open, for example to the introduction of new technologies or procedures.

One-to-one projects can in many respects be characterized as *top-down projects*, driven by governments, communities and schools and ultimately realized by teachers and pupils on the classroom level. Communities and schools develop strategies and measures to integrate technologies into an existing infrastructure for learning. Teachers are key agents in these processes, since they ultimately are responsible for the pedagogical work on the classroom level. But schools are not only changed top-down and in an orderly way, by means of strategic initiatives, projects and measures. Schools are also changing due to the pressure from more general societal trends (Parsons, 2017). When it comes to changes of schools' infrastructure for learning, due to these more general trends, the mobile phone is an interesting case. Mobile phones are rarely the choice for such purposes in education, even though they have been argued to be able to support many educational activities for which schools already invest in other information technologies, (Sharples, Arnedillo-Sanchez, Milrad, & Vavoula, 2009; Thomas, O'Bannon, Britt, 2014). Mobile phones are generic digital tools, that can be used to perform a variety of tasks in our daily activities. They most often "fit" into the *technical* infrastructure of schools, giving access to both local intranets and the internet. Mobile phones have also been identified as potentially relevant resources to be employed in education (Cochrane, Antonczak, Keegan, & Narayan, 2013; Pachler, Bachmair, & Cook, 2013; Song, 2014). And most importantly, mobile phones, being ubiquitous, are typically introduced into the classroom by the students, rather than by teachers or schools. However, use of mobile phones in educational settings has fueled controversy and debate. They have often been portrayed as a nuisance to classroom activities (Ott, 2014). In many countries, including Sweden, actions have been taken on a federal level to curb students' use of mobile phones in school (Kukulska-Hulme, 2013). In 2007, Swedish teachers were given the legislated authority to confiscate objects that disturb or threaten the safety of the education (SFS. 2010:800). But regardless of such debate, students bring their devices wherever they go and consequently mobile phones are ubiquitous also in

schools (Bachmair & Pachler, 2015). And whether schools implement a policy for prohibition of mobile phones or not, seem to have little effect on the number of students' mobile phones present in schools (Gao, Yan, Zhao, Pan, & Mo, 2014; European Commission, 2013).

As pointed out above, teachers are central in the construction of the classroom practice (Van Driel, Verloop, Van Werven, & Dekkers, 1997). Successful integration of technology is dependent on that teachers, as an ideal, must act as active agents of change (Ertmer & Ottenbreit-Leftwich 2010). In schools, teachers are those who in their practice, implement new educational policies (Gao, et al., 2014; Parsons, 2017). This put teachers in close contact with the appliance of the legislation and the direct matter of managing the use and presence of mobile phones in the classroom. How teachers perceive mobile phones; as pedagogical recourses or, for that matter, disturbing objects is important to understand in order to give insight into the conditions for the integration of mobile phones into educational practices, in an infrastructure for learning. In relation to practices on the classroom level, we argue in line with Thomas et al (2014), that it is important to explore teachers' permission of mobile phone usage in their classrooms.

The aim of this paper is to explore teachers' permission of students' use of mobile phones in their classrooms.

The research questions are:

1. To what extent do teachers' permit students to use mobile phones in the classroom?
2. For what purposes are mobile phone use in the classroom permitted?
3. How are teachers' permission of students' use of mobile phones related to their beliefs about ICT in education?

2 Background

2.1 The evolvement of infrastructure for learning

In this study, we use the notion of infrastructure (Star & Ruhleder, 1996; Guribye & Lindström, 2009) as a backdrop to understand technology integration in schools. From the student perspective, the learning infrastruc-

ture would include a multitude of different technologies, some owned, maintained and introduced by the school and some owned by themselves. Many students involve their phones to manage their schoolwork (Alexandersson & Davidsson, 2016; Ott, Grigic Magnusson, Weilenmann, Hård af Segerstad, 2017). Thus, we consider the mobile phone a potential part of such an infrastructure for learning. When new technologies are brought into social practices there is a need for a process of adapting, accommodating or possibly rejecting the new tools made available (Wenger, 1998), in an infrastructural perspective this means that the evolution an of infrastructure is a social process in which the infrastructure is redefined in and through its use (Bygholm & Nyvang, 2009; Pipek & Wulf, 2009). This process demands effort and engagement from the participants (Star & Bowker, 2006). We understand the conflicts and debates in society and locally in classrooms as parts of this struggle, handling the evolution of the infrastructure for learning where the students' mobile phones are parts.

Orlikowski (1996) suggests that integration of technology is not a revolutionary but a gradual process, where intentional and improvised actions build on each other, creating almost unnoticeable transitions. Regarding mobile phones the evolution of the infrastructure for learning would then be a collaborative process in which the students introduce the technology and the teachers permit or ban the use in the situation. Charles (2012) discusses permitting of mobile phones in the classroom as the teachers' grade of implementing locally established rules and protocols, a process driven by the students' wish to use mobiles in the classroom. In this study, we suggest teachers' *explicit* or *implicit permission* to describe the dynamic decision work teachers have to engage in continuously in a classroom where mobile phones are not unilaterally prohibited. Permission does not necessarily reflect teachers' intention to include technology in their teaching. As well as, not permitting use cannot be understood as equal to confiscation. To be able to further develop our knowledge of the problems of using mobile phones in the classroom, permission must be understood as a continuous work that defines the boundary between permitted and banned uses in school practice. Central to such a process is then teachers' judgement of, and attitude towards the new technology. Research on the use of technology in other contexts have established the importance of

subjective perspectives of the user (e.g. Venkatesh & Davis, 2000; Bagozzi, 2007). The evolution of the infrastructure for learning then becomes dependent on the teacher's attitude towards information technology in general and attitude towards specific use (Teo, 2014).

2.2 Mobile technologies in school

The possible benefits of involving mobile technologies for learning have been a topic for research for many decades now. Features of the mobile phones have been argued to promote for example: student interaction and active learning (Cobb, Heaney, Cochran, & Henderson-Begg, 2010); students' learning with contemporary cultural resources (Cook, Pachler, & Bachmair, 2011); personalization of the learning technologies (Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sanchez, & Vavoula, 2011); learning anywhere and anytime (Traxler, 2007). Being personal devices, it has been argued that the integration of mobile phones could also potentially open up school practice to the surrounding society and contribute to pedagogical development.

2.2.1 Mobile phones - a contested technology in school

To explain the controversy concerning inclusion of mobile phones for learning in school Ling (2004) and Sharples (2002) suggest that the use of mobile technologies like the mobile phone can be understood as disruptive to other locally ongoing activities. For example, mobile phones might ring, or be used for calling, creating conflict in settings where there is supposed to be silence. They can be used for cheating when taking tests (Baker, Lusk, & Neuhauser, 2012; Campbell, 2006). Mobile phones can cause problems mediating peer collaboration not sanctioned by the teacher (Sharples, 2006). In schools that have decided on rules restricting mobiles phone usage, using them could be an intentional subversive act of the students challenging the teacher's authority (Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sánchez, & Vavoula, 2009). Indeed, the mere presence, or availability of mobile phones is sometimes considered a problem (Thornton, Faires, Robbins, & Rollins, 2014). Baker et al. (2012) found that in college classrooms in the USA, mobile phones even when used in silence mode are considered as less appropriate in the school setting than laptops used silently. Even outside of the educational setting Ling (2004)

shows that mobile phones "clashes with many social situations, particularly those governed by a heightened sense of normative expectations" (p. 125).

Studies also report that young people experience that adults lack appreciation of the learning taking place as part of their everyday mobile phone use. Even though learning with mobile phones might take on less culturally accepted forms, they can be argued as not being inferior (Chan, Walker & Gleaves, 2015). Being a personal technology used in an educational setting mobile phones create an overlap between educational and personal or private use. This overlap creates potential for facilitative as well as obstructive roles of the technology. Such an overlap is nuanced and some but not all personal uses can potentially be beneficial for student learning (Gurung & Ruthledge, 2014). In addition to distractions and misuses in relation to school work, there are also other factors affecting how mobile phones are perceived. Being ubiquitous, the technology is ready to be used even when not visibly used (Weiser, 1991). The connectivity of the ubiquitous technology furthermore offers its holder constant exposure to potential social interaction in activities beyond what is available in the physical space (Chan, Roschelle, Sherry, Kinshuk, Sharples, & Brown, et al. 2006).

2.3 Teachers' beliefs about technology in education

The attitude towards the usefulness of a technology in relation to specific goals, as well as general or normative attitude towards technology, impacts the degree of acceptance of the technology. Davis (1989) explains technology uptake as mainly dependent on two factors; perceived usefulness and perceived ease of use. Venkatesh and Davis (2000) additionally establish perceived usefulness as the most powerful influencing belief, and also explores what underlying factors (norms, image, job relevance, etc.) that influence perceived usefulness. This line of reasoning is dependent on the idea that the individual's intention to use is a foundation for actual use in practice (Bagozzi, 2007). The importance of attitudes and norms concerning the uptake of technology is also established within the educational sector (Teo, 2010).

Beliefs construct attitudes, and drive actions (Richardson, 1996). Teachers are no exception, their beliefs of teaching, learning and technol-

ogy have major importance for their attitude towards technology and for their actual technological integration practices (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). Teachers' specific beliefs about a technology are dependent on their fundamental pedagogical beliefs of teaching and learning. Hence, teachers' use of technology have been argued to be interrelated to their perception of what education is about and how it should be organized (Kim, Kim, Lee, Spector, & DeMeester, 2013). Research over-emphasizing attitude as having impact on the acceptance have however received criticism for being over-simplistic and deterministic, since it fails to account for social and cultural factors, as well as affects and emotions (e.g. Bagozzi, 2007).

2.4 Teachers' attitudes towards mobile phones in education

Teachers' attitude towards mobile phones in education have been studied both within teacher training, as well as among in service teachers. In a survey Thomas, O'Bannon, & Bolton (2013) found that 70,5% of the studied teachers (29 elementary school, 19 middle school, and 30 high school, N=78) believed that use of mobile phones could benefit instruction in the classroom. Almost 50% of the teachers in the study did not see mobile phones as distractive in school. O´Bannon and Thomas (2015) surveyed 245 pre-service teachers. 45% of the pre-service teachers stated they did support the use of mobile phones in their future classrooms. 30% of the pre-service teachers were uncertain, and 25% were reluctant to support use of mobile phones in their future classrooms. Internet access, using the mobile as a polling devices and educational apps were considered the primary perceived beneficial functions of the mobile phones for school related work. Social networking, Tweeting and texting were perceived as the least beneficial functions among the pre-service teachers. Even though there was an ambiguity in their material, O'Bannon and Thomas (2015) argued that teachers' negative attitude towards mobile phones was a barrier for integration that is decreasing over time.

In a survey answered by 1121 teachers (response rate of 15%) 59,4% of the respondents stated that they permitted their students to use their mobile phones for school related work. The most permitted uses were using the mobile phones to access the Internet and the other was for using apps, for example the calculator and calendar (Thomas et al., 2014).

These findings suggest that it might not be relevant to discuss the attitudes towards the mobile per se, but rather attitudes towards specific functionality of the mobile phone. O'Bannon and Thomas (2014) found that teachers' attitudes towards the use of mobile phones correlate with personal smartphone ownership and age. They found that the teachers of 50 years and older generally were less positive to the use of mobile phones for learning in school. In this group smartphone ownership were lower than among younger teachers. They suggest that the older teachers were less able to develop technological knowledge, confidence and self-efficacy regarding the use of mobile phones, since they were not as familiar to the technology. Charles (2012) also identify an established correlation between age and teachers' tolerance of mobile phones in class. She also conclude that there are three sorts of permitting teachers; teachers permitting mobile phones until they are used in ways disrupting the school activities; teachers permitting uses that could be accommodated without disruption of the classroom management; and lastly teachers that don't care that there are mobile phones used in the classroom.

3 Method

The study presented in this paper focuses on teachers in four upper secondary schools. These schools have not had any outspoken local policy or plan for how students and teachers are to deal with mobile phones in the classroom.

3.1 Data collection

The data analyzed in this paper is drawn from an evaluation of the municipality's teachers' pedagogical integration of digital learning resources in school practice (Player-Koro, Karlsson, Ott, Tallvid, & Lindström, 2014). The data was collected through an online questionnaire distributed to all teachers working in four public upper secondary schools in a mid-sized (pop. approx. 130.000) Swedish municipality in 2013. The total population were 337 teachers. 276 (82%) teachers took the questionnaire.

3.2 Analysis

The data analyzed in this study is taken from three sets of questions in the questionnaire. The first set concerns background and demographic data. Having established the relation between attitudes and use, the second set concerns questions regarding teachers' use and beliefs of ICT in educational settings. And finally, we relate this to questions concerning teachers' permission or restriction of mobile phone use in their classrooms.

The questions regarding teachers' permission to use mobile phones, were presented in two-steps, first a question concerning teachers' permission of mobile phones during lessons in general (TPERM), and secondly questions concerning permission to use the mobile phone for a number of specific purposes. The second question was only answered by those who reported that they permitted use at all in the first question.

Due to attrition in the section of the survey concerning the level of teachers' permission of students' mobile phone use during lessons, this section was completed by 63% (n = 210) of the population. Analysis of the attrition provided no statistically significant correlation between not completing the survey and age, gender or what school the teachers taught at.

4 Results

In the result section, we first present the teachers' extent of permission and elaborate on specific uses premiered. We then scrutinize demographic aspects on permission and unpack the teachers' beliefs regarding ICT in the education in relation to their permission of students' use of mobile phones.

4.1 Teachers' permission of mobile phones in the classroom

TPERM measures to what extent the teachers' permit students to use mobile phones during lessons. Of the 63% of the total population that responded to TPERM, 28% responded that they did not permit any use at all. 72% (n = 151) responded that they during their lessons to some extent permit the students to use their mobile phones (2-5 on Likert, distribution: 2:38%, 3:23%, 4:7%, 5:4%, M = 2,69, median = 2). 8 of the 210 respondents responded not relevant. For further analysis, we group not

relevant with the not at all category, since they did not report any permission. Only 11% of the teachers permitted students to use mobile phones to a high or very high extent. The numbers are similar to those reported by Thomas et al. (2014).

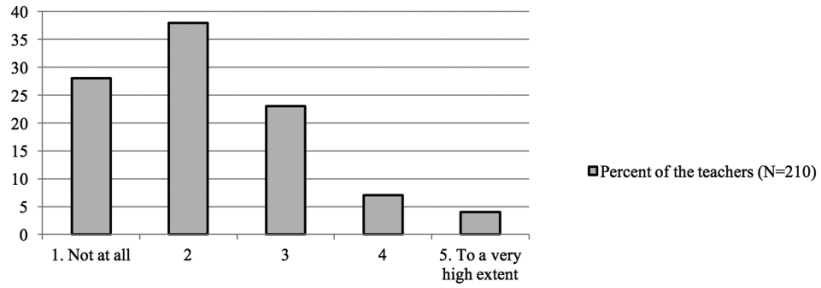

Figure 1. Percentage of teachers permitting the use of students' mobile phones during their lesson time (TPERM)

There were no statistically significant correlations between TPERM and teachers' sex, or at which of the four schools the teachers worked. Interestingly, there was no significant correlation with age as suggested by O'Bannon and Thomas (2014).

4.1.1 Teachers' permission of different mobile phone uses

To further develop the analysis of how and if teachers permit mobile phones in their classrooms we included questions of permission related to specific mobile phone use and mobile phone use related to teachers' main subjects. These questions were answered by those teachers (n = 151) that had reported that they permitted any mobile phone use at all (Table 1). In the table below the permission is also shown in relation to the subject taught by the teacher.

Table 1. Teachers' permissions of mobile phone lesson usages.

Lesson use	All	All	Sci-ence	Math	Social science	Language	Vocational
Infrastructural usage	*M*	*S D*	*M*	*M*	*M*	*M*	*M*
Use learning management system	3,9	1,3	3,7*	3,3*	4,2	4,3	3,3*
Send/receive school related messages/email	3,2*	1,5	2,9*	2,7*	3,4*	2,9*	3,1*
Make/receive school related calls	3,1*	1,5	3,0*	2,8*	3,3*	2,8*	3,1
Listening to radio or music	3,1	1,2	3,4*	3,9	3,3	3,3	2,8*
Generic tool use							
Browsing for information and facts, and use online web services	3,7	1,3	3,7*	3,6	4,1	4,2	3,3
Take photos/video as part of school work	3,2*	1,4	3,1*	2,6*	3,4*	3,3*	3,3*
Note taking and writing	3,4	1,4	3,2*	3,0*	3,9	3,9	3,2*
Use clock and calendar	3,7*	1,3	2,2*	3,6*	4,0	3,8	3,6*
Didactical instrumental usage							
Use pedagogical apps	3,1*	1,6	2,8*	3,0*	3,3*	3,4	2,7*
Use calculator app	2,9*	1,7	3,8	3,9*	2,6*	2,1*	3,4
Watch TV/movies as part of school work	2,7*	1,5	2,2*	2,1*	3,1*	2,7*	2,5*
Personal usage							
Send/receive personal messages/ email	1,7	0,8	1,7	1,7	1,7	1,5	1,75*
Make/answer personal calls	1,6	0,7	1,7	1,6	1,6	1,5	1,81*
Use social media (such as Face-book, twitter)	1,2	1,0	1,4	1,3	2,1*	1,8	1,72
Gaming	1,2*	0,6	1,2	1,1	1,2	1,1	1,28
n	*151*		*25-26*	*20-21*	*60-61*	*28-29*	*30-32*

*Multimodal distribution

In the data displayed in table 1 there are some of the permitted uses that must be commented. The responses were not overall normally distributed. On those uses where permission was not unimodal distributed the mean value is misleading, and there are groups of teachers that despite the mean value, are very permitting and very restrictive. The teachers' responses are normally distributed for permission of uses in which the mobile phones can be understood as an infrastructural resource (permitting use of the LMS and permitting students to listen to radio or music), or as a generic tool (permitting students to save and transfer files, permitting students to do note taking and writing, and permitting students to browse for information and facts, and use online web services). Uses where permission was not unimodal distributed were uses that can be understood didactical

instrumental uses dependent on the individual teacher's subject and use of technology in the teaching, for example permission to use pedagogical apps, and permission to use the calculator.

The teachers that responded not relevant on the permission of different usages were less than 10% in all usage categories, except two: *use calculator app* 29% and *use pedagogical apps* 13%. The 29% not permitting use of calculator app were teachers in subjects where calculation might not be commonly occurring (e.g. social sciences, aesthetics, language, sports and health). The mean value for science and math teachers are higher than for the rest of the teachers. In social sciences and language, uses that reaches out of the classroom were more permitted than in math, in which listening to music and radio was more permitted. Thus, we argue that the permission of mobile phone use reflects the traditional school work methods in the various subjects. Social sciences are more explorative as subjects than for example math, in which it is instead useful for students to seal out disturbances and enhance focus on a task by listening to music.

There is a gap in the data that forms two usage groups. The gap is between uses that are *permitted* to a high degree and uses *not permitted* to a very high extent. Most uses are gathered in a group between the mean values of 3,9 and 2,7. Then there is a leap to those uses with the lowest mean values (< 1,7). This indicates that there is some diversion in which uses are permitted. The uses in the two groups show that uses that are personal or that the teachers reported that they themselves are usually not including in their teaching or task design (social media and gaming) are less permitted than other uses that are more aligned with existing practice (such as calculation, accessing LMS and browsing for information).

4.2 Relations between teachers' permission of mobile phones and their beliefs about use of ICT in education.

The investigation of associations between teachers' beliefs of technology in the education and TPERM, draw on an exploratory factor analysis (EFA) presented in Player-Koro et al. (2014)The EFA showed five factors or latent variables (presented in descending order): 1. A productive learning environment with ICT as tools; 2. The teacher pedagogical-digital competence; 3. Mobile phones and social media in the school; 4. The school organization's work with ICT; and 5. ICT as problematic.

Table 2 displays those manifested variables in the EFA that are of relevance to our study of mobile phones, and with factor loadings 0,40< and -0,40>. The questions were all preceded with the question: Below follow a number of claims. To what extend do you agree with these?

Table 2. EFA of teachers' beliefs concerning ICT (Player-Koro et al. 2014).

Manifest variables	F1	F2	F3	F4	F5
The use of digital resources for learning is important for students to be active citizens.	.76				
The computer increases the possibilities to individualize the education.	.74				
Digital resources for learning facilitate students' learning.	.74				
Digital resources for learning prepare students for their future work.	.73				
Digital resources for learning increase the students' motivation for school work.	.73				
The use of digital resources for learning enhances the students' skills in the subjects I teach.	.72				
Digital resources for learning promote that students can do schoolwork on other times than the scheduled.	.69				
The computer is a mandatory tool for the students during my lessons.	.63				
It is preferable that the education is designed for students to use digital tools.	.62				
The use of digital resources for learning promotes collaborative learning approaches.	.50				
Digital resources for learning promote that students can participate in the education without being on the set in the classroom.	.50				
I know a lot about different digital resources for learning.		.87			
I find it easy to adopt new digital resources for learning.		.86			
I stay updated of which new digital resources for learning that is developed within areas of importance for me.		.82			
I often explore new appliances and opportunities with digital resources for learning.		.81			
I know how to solve most technological problems that occur when I use digital resources for learning in my education.		.76			
I am familiar with digital resources for learning that could be used in that/those subjects in which I mostly teach.		.72			
I am content with my way of applying digital resources for learning in my teaching.		.56			

Social media is a resource in the schoolwork.	.68		
The students' use of social media enriches school work outside of the classroom.	.65		
The students' use of mobile phones is a resource for the school work.	.62		
There is a need for clear and common rules for the use of digital tool in the school.	-.61		
It is essential that the school has a common policy for the use of digital resources for learning.	-.60		
The students' respect the rules regarding the use of digital tools in the school.	.56		
It is reasonable to confiscate students' mobile phones.	-.44		
The students should have the opportunity to use their private digital tools (laptops, tablets and mobile phones) in the school work.	.44		
The students' use of social media disrupt work in the classroom.	-.41		
The board of the school has appointed time for us teachers to develop a didactical appliance of digital resources for learning.		.78	
The organization facilitates for me to meet with colleagues so that we together can develop the didactics regarding the use of digital resources for learning.		.75	
There is a clearly defined plan or strategy for the use of digital resources for learning at my school.		.72	
I am content with board of the school's way to support the use of digital resources for learning.		.65	
The technological infrastructure (network, computers etc.) at the school works.		.45	
The use of digital resources for learning increase my work load as teacher.			.68
Digital resources for learning limit my didactical alternatives.			.63
The students are busy doing other activities than school work when digital resources for learning are utilized in the education.			.59
The students' mobile phones often disrupt the work in the classroom.			.54
Technological ´breakdowns is an obstruction in the teaching I intend to carry.			.45
The computer is a relevant tool in my teaching.			.40

For the analysis, the manifest variables in the EFA are indexed factor by factor (INDEX1-5). This section, presents the analysis of those factors (1,3,5) that significantly correlated with TPERM i.e. teachers' general permission of students using mobile phones. The variables in the EFA were responded to on a scale from 1-5. In the indexes, the scale has 4 levels (1=Low value, 4=high value), corresponding to the intervals in the scale 1-5.

4.2.1 Teachers' beliefs of a productive learning environment with ICT

The first factor contains questions concerning teachers' beliefs of a productive learning environment, with ICT as tools. Table 3 displays the cross tabulation of TPERM and the indexation of the teachers' responses to the questions in factor 1 (INDEX1).

Table 3. INDEX1, teachers' beliefs of a productive learning environment with ICT (Horizontal) and TPERM(vertical), displayed %.

	1	**2**	**3**	**4**	**Total**
Not at all	3,8	8,2	9,8	3,8	25,5
2	3,8	13,6	15,8	6,0	39,1
3	0,5	4,3	14,1	4,3	23,4
4	0	0,5	3,8	2,7	7,1
To a very high extent	1,1	1,1	0,5	2,2	4,9
Total	9,2	27,7	44,0	19,0	100

Note. n = 184.

Teachers in the studied schools have strong beliefs that ICT is part of a productive learning environment. 63% of the teachers are in the higher value categories in the index. The correlation between index and TPERM is statistically significant, but not very strong (p = .002, r_s = .216, n = 184). Noticeable is that 13,6% of the teachers have positive beliefs of ICT (value 3 and 4) but still do not permit mobile phones.

4.2.2 Teachers' beliefs of mobile phones and social media

The third factor contains questions concerning mobile phones and social media in school. Table 4 displays the cross tabulation of TPERM and the indexation of the teachers' responses to the questions in factor 3 (INDEX3).

Table 4. INDEX3, teachers' beliefs of mobile phones and social media in school (horizontal) and TPERM (vertical), displayed %.

	1	**2**	**3**	**Total**
Not at all	14,4	8,6	3,2	26,2
2	15	19,8	4,8	39,6
3	1,6	12,8	9,1	23,5
4	0,5	1,1	4,8	6,4
To a very high extent	1,1	0	2,3	4,3
Total	32,6	42,2	25,1	100

Note. n = 187.

Of the teachers that responded to TPERM no one ended up in the fourth category in Index 3, not even those who permit mobile phones to a medium or high extend. In fact, only 25,1% of them were slightly positive to the impact of mobile phones and social media on the school work. The correlation between INDEX3 and TPERM is statistically significant, and the correlation is quite strong (p = .000, r_s = .453). This correlation shows that the teacher are generally more critical to mobile phones and social media, and those attitudes are reflected in their permission of mobile phone usage during lessons.

4.2.3 Teachers beliefs of ICT as problematic.

The fifth factor describes questions concerning teachers' perception of ICT as problematic in school. Table 5 displays the cross tabulation of TPERM and the indexation of teachers' responses to the questions in factor 5 (INDEX5).

Table 5. INDEX5, teachers' beliefs ICT as problematic in school (horizontal) and TPERM (vertical), displayed %.

	1	2	3	4	Total
Not at all	0,5	10,2	13,8	2,0	26,5
2	1,5	19,4	15,3	1,5	37,8
3	2,0	14,3	7,1	1,0	24,5
4	0	5,6	0,5	1,0	7,1
To a very high extent	1,0	2,0	1,0	0.0	4,1
Total	5,1	51,1	37,8	5,6	100

Note. n = 196.

Table 5 shows that almost 56,2% of the teachers do not think that ICT is problematic to any higher degree (value 1 and 2). One variable that measures teachers belief that mobile phones disturb the work in the classroom (MOBDIS) is part of INDEX5. If MOBDIS is excluded from INDEX5 then the number of teachers that do not think ICT as problematic rise to 72,2%. There is a statistically significant correlation between INDEX5 and TPERM (p = .001, r_s = -.239). Our analysis show that mobile phones is perceived as something else than the other ICTs used in school. There is a connection between attitude towards ICT and mobile phone permission - those teachers that do not consider ICT as problematic are slightly more permissive of mobile phones. Critical attitude towards the use ICT is strongly affected by the attitude towards mobile phone use.Table 6 displays the cross tabulation of MOBDIS and TPERM.

Table 6. MOBDIS, teachers' perception of mobile phones as disturbing (horizontal) and TPERM (vertical), displayed %.

	I do not agree	2	3	4	I wholly agree	Total
Not at all	1,5	2,4	4,4	1,5	17,5	27,2
2	1,9	4,4	4,9	11,7	15,0	37,9
3	1,0	7,3	3,4	5,8	6,3	23,8
4	0	1,9	1,5	2,4	1,0	6,8
To a very high extent	1,0	0,5	1,0	0,5	1,5	4,4
Total	5,3	16,5	15,2	21,8	41,3	100

Note. n = 206.

Table 6 shows that most teachers believe that mobile phones disturb the education in the classroom. At the same time 37% of the teachers are in the three bottom categories ("I do not agree", "2" and "3"). These teachers are slightly more permissive of mobile phones. There is a statistically significant correlation between MOBDIS and TPERM (p = .000, r_s = -.273), which, quite unsurprisingly indicate that teachers who perceive mobile phones as disturbing also are less permissive.

4.3 Relations between teachers' intentional use of mobile phones and social media.

In the questionnaire, the teachers were also surveyed regarding intentional utilization of social media and mobile phones in their teaching. Table 7 displays the cross tabulation of the teachers' intentional utilization of students' mobile phones (MOBINT) and the teachers' intentional utilization of social media in their education (SOCINT).

Table 7. SOCINT, use of social media in the education (vertical) and MOBINT, use of mobile phones in the education (Horizontal), displayed %.

	Never	**At least once per month**	**1-3 times per week**	**More than 3 times per week**	**Daily**	**Total**
Never	28,7	12,2	2,8	1,1	5,0	49.7
At least once per month	10,5	12,7	2,2	1,1	3,9	30,4
1-3 times per week	2,2	3,9	1,7	0	0	7,7
More than 3 times per week	1,1	0,6	0,6	1,7	1,7	5,5
Daily	0,6	0,6	0,6	0,6	4,4	6,6
Total	43,1	29,8	7,7	4,4	14,9	100

Note. n = 181.

In relation to social media, the teachers' use of mobile phones is slightly more restricted. However, the two variables have a significant correlation (p = .000, r_s = 2,81). Those teachers that are using social media the most are yet less frequent encouraging of students' use of mobile phones in their teaching. SOCINT is bimodal and 14,9% of the teachers use social media in their teaching every day. That is more than double to the use of

mobile phones. Nevertheless, there are some teachers that support students' use of mobile phones. To no surprise MOBINT correlates statistically significant with TPERM ($p = .000$, $r_s = .355$, $n = 191$).

5 Discussion

Our results show that many of the studied teachers believe that ICT have a role in a productive educational practice. Previous research has identified that there is a connection between teachers' pedagogical belief and the integration of ICT in education (Kim et al., 2013; Ertmer, 1999). From our study, we draw the conclusion that this is also the case with the level of permission of students' own mobile phones, not only ICT introduced by the school. We see a significant correlation between the attitude towards ICT and the levels of permission of mobile phones. However, the correlation is weak and this indicates to us that mobile phones are understood as different from other ICTs used in education. They are perceived as more problematic than the other ICTs. Additional factors are needed to more fully explain the attitude to integration of mobile phones. We argue that one relevant factor to be studies in the future would be how teachers' view of education and how educational settings should connect to the outside world, i.e. to what degree school should reflect the tools and technology commonly used in the surrounding society.

We do acknowledge the importance of individual teacher's attitude towards the usefulness of technology (e.g. Teo, 2014) but argue that integration of technology is not exclusively depart from the idea of individuals' intention. The design of school tasks must be considered a collective process. When teaching, teachers give a task based on a predefined curriculum-based content. However, a school task evolves as a complex process not only guided by the teacher executing it. Through their activities and tool involvement, students become intrinsic participators in a continuous evolution of the task. Students elaborate their ideas into what the task they shall carry out is and what methods and tools to deploy (e.g. Tallvid, 2015). Teachers have at these occasions to restrict or permit off-task development of the original task. In a classroom where students are equipped with mobile phones, tablets or laptops, such development often involve the use of ICT (Tallvid, Lundin & Lindström, 2012). When mobile phones are introduced in everyday practice, permission is given through not enforc-

ing the possibility to restrict. Students, through practically involving their mobiles, suggest them as a relevant part of practice, and permission then opens up for the development of the infrastructure for learning. The development of the infrastructure is dependent on these challenges of the current state, and these challenges in turn can be understood as one aspect leading to tensions in practice. If the tensions are addressed constructively they can be used as indicators of areas that need extra attention (Edwards, Jackson, Bowker, & Knobel, 2007). In these terms, the debate concerning mobile phones in school can then be extended to a question about what school practice is and what infrastructure it is dependent on. Such a process demands effort from involved participants (Star & Bowker, 2006) in this case students and teachers. From our results, we can see that in that process the effort of some teachers is more powerful than that of others. As an example, social media which is not considered as a resource for learning by most teachers, is nevertheless included as an infrastructural resource by a small group of pioneering teachers. Those teachers' use of social media seems to benefit permission to use mobile phones, more than permission of mobile phones benefits the use of social media.

It is somewhat surprising that even though the results show that the teachers perceive mobile phones as more disturbing, and are more negative to them than to other ICTs, and that there has been little outspoken intention from schools and teachers to make use of students' mobile phones in educational activities, it is clear from both our results regarding teachers' permission of mobile phone usage and previous research that mobile phones have been integrated in the everyday practice of many students (e.g. Gao et al., 2014; Charles, 2012; European Commission, 2013). Understanding this as a process of changing the practice and infrastructure, it has been accompanied with little less resources than legislative rights to ban the phones. In the classrooms where it is part of practice, this has happened without a plan, formulated organizational goals or policy incentives for the teachers or the students, or training to do so in a successful manner. Our results show that teachers' intentions concerning the usefulness and utilization of technology for learning in school strongly affects for integration. Without guidelines or training such intentions and ideas for suitable use will become highly dependent on broader attitudes towards the digitalisation of education. Similar to previous studies of

adoption (e.g. Venkatesh and Davis, 2000) we see how the understanding of usefulness is central in the integration new technologies into the infrastructure supporting the practice.

Our results point to how teachers' attitudes are more positive when the use of mobile phones are connected to a pedagogically relevant task, i.e. the teachers permit students to use what are perceived as the available technologies suitable for the educational task at hand. Being dependent on individual teacher's attitudes also emphasizes an individually driven rather than an organizationally orchestrated change. Frameworks predicting adoption typically deal with pedagogical beliefs and attitudes as stable factors. In the case of mobile phones, mobile phones are argued to be able to open up school practice and contribute to pedagogical development (e.g. Song, 2014 & Cochrane et al., 2014). As such the absence of a plan for the implementation of the technology could have been opening up for generating new and unforeseen appliance and use, as well having the effect of challenging and evolving pedagogical beliefs. Sandholtz & Reilly (2004) state that the successful implementation of technology in education can be easier when teachers are not instructed to utilize technology in for specific purposes, since pressure is lifted from them to develop their own technical competence in using technology, as well as not needing to develop skills in instructing students in their use of the technology. Based on the results from our study we argue that when not demanding of teachers to use or master mobile phones in their teaching or to guide the students in using them, the most emergent first-order barriers, such as access to technology and lack of professional development have been circumscribed. The students' utilization of mobile phones has instead been self-organised. Thus, when teachers are deciding on permitting or not permitting the use of mobile phones, teachers have 'only' had to evaluate the function concerning its relative pedagogical use within the practice. The decision work has forced the teachers to repeatedly having to reconsider the role and usefulness of the new technology, and relating this use to their concept of good educational practice. However, for the group of teachers whom are less positive to the use of mobile phones or technology, and thus less permissive, the legislation has emerged as yet another first-order barrier, blocking engagement with mobile phones in the classroom.

6 Conclusions

Our data shows that even though there are large exceptions: the teachers are generally positive towards ICT, and ICT is quite frequently applied in their education as a resource in the infrastructure for learning. We conclude that most teachers permit students to use mobile phones during lessons when the use of mobile phone supports the purpose of the lesson. Teachers' permission of mobile phone use during lessons is affected, but not dependent on teachers' attitudes towards technology in the education and particularly mobile phones. Hence, there is an unintentional integration of technology into the infrastructure for learning in school going on.

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ARTICLE 4

"IT MUST NOT DISTURB, IT'S AS SIMPLE AS THAT"
STUDENTS' VOICES ON MOBILE PHONES IN THE INFRASTRUCTURE FOR LEARNING IN SWEDISH UPPER SECONDARY SCHOOL.

Ott, T., Grigic Magnusson, A., Weilenmann, A., & Hård af Segerstad, Y. (2017)
Education and Information Technologies

Educ Inf Technol
DOI 10.1007/s10639-017-9615-0

"It must not disturb, it's as simple as that": Students' voices on mobile phones in the infrastructure for learning in Swedish upper secondary school

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Received: 17 February 2017 / Accepted: 17 May 2017

Abstract Drawing from a survey and focus group interviews, this study explores how Swedish upper secondary students reason about the usage of their personal mobile phones in school. As a contribution to the debate around the mobile phone's role in school, we present the students' own voices relative to the question of regulating mobile phone use. We use the notion of infrastructure for learning (Guribye and Lindström 2009) to analytically approach the social and technological dimensions of the students' narratives on their use of mobile phones in school practice. The students' narratives present an intricate account of students' awareness and concern of the implications of mobile phone presence in school. The students describe that the mobile phone is both a tool that facilitates their school work and a distraction that the teachers pursue. In school, the students are balancing their mobile phone usage with the teachers' arbitrary enforcement of policy. Despite this process, the mobile phone is becoming a resource in the students' infrastructure for learning. The findings from this study add to the limited body of research on the use of mobile phone in upper secondary school from a student perspective.

Keywords Mobile phones · Infrastructure for learning · Upper secondary school · Students' perspective · Bring Your Own Device (BYOD)

1 Introduction

Digital technologies such as desktop computers, laptops and tablets are technologies that schools have continuously made investments in (Perselli 2014). At present, as

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Published online: 13 June 2017

much as three out of four upper secondary students in Sweden are provided with access to a personal computer by their school (Skolverket 2016a). However, the technology distributed by the school is not the only technology that upper secondary students have access to. Nearly every student in Swedish upper secondary schools have access to a personal smartphone, in their own possession (Alexandersson and Davidsson 2016). Generally, the presence of students' personal technology in school has not been appreciated. School settings have proven to be arenas in society that are not receptive and tolerant to the use of mobile phones (Ling 2004). The presence of mobile phones (including smartphones) in school has been followed by debate and discussions on what schools should make of the technology. Despite that some schools or individual teachers have occasionally opened up for use of the mobile phone for school work, it is well documented that the mobile phone has turned out to be a controversial technology in schools (e.g., Campbell 2006; Gao et al. 2014; Thomas and O'Bannon 2014). Rather than picking up on possible educational applications, the recurring suggested means to cope with the presence of mobile phones in secondary schools in many countries has been to ban them (Kukulska-Hulme et al. 2011; O'Bannon and Thomas 2015; Ott 2014). Nevertheless, students keep on bringing their mobile phones to school.

In this paper, we address this controversy from the perspective of the students. Drawing upon the notion of infrastructure as a layered and relational ecology of tools and actions (Star and Ruhleder 1996), we examine the presence of students' mobile phones in school. Infrastructure can be understood as two part, first there is a universal service infrastructure, open to all citizens, second there are work oriented infrastructures, open only to participants in specific practices (Hanseth and Lundberg 2001). In educational practices, the work oriented infrastructure is an infrastructure for learning that consists of "a set of resources and arrangements – social, institutional, technical – that are designed to and/or assigned to support a learning practice" (Guribye and Lindström 2009 p. 112). When students bring their mobile phones to school, they are bringing a technology into school without any formal affiliation to school's infrastructure for learning. Nevertheless, any technology existing within an infrastructure is bound to have impact on the infrastructure (Guribye 2005). Hence, the presence of mobile phones in school should not be neglected.

Most previous research about mobile phones has focused on teachers' use and beliefs of mobile phones, and on higher-education. This paper builds on an understanding that, in education, students are also essential stakeholders shaping the practice (Parsons 2017; Tallvid et al. 2012). In Sweden, the importance of students' influence is even stipulated in the upper secondary curriculum, which state that schools should include and encourage students to participate in the design of their education (Skolverket 2011). Nevertheless, students' opinions and reasoning around their use of mobile phones for learning in school are rarely presented in the public debate or in research. Therefore, in this study we explore how Swedish upper secondary students reason about their usage of mobile phones in school. The overarching aim of our study is to contribute to the understanding of how students' use of the mobile phone in school impact their school practice, and provide an insight into how students reason about managing mobile phones on the boundary of the infrastructure for learning in school. Since upper secondary education is a concern for many stakeholders (in

2013, 98,5% of the Swedish adolescents (Skolverket 2014) attended upper secondary education) we argue that it is important to study upper secondary school students' perceptions regarding all aspects of their school practice, in particularly their reasoning about the controversial issue of mobile phone use as a resource in the infrastructure for learning.

This paper is organized as follows: first we provide a background of related research on students' use of mobile phones in school. In the method section, the survey and the focus group interviews which make up the data in the study are presented more in detail. In the third section, we present significant survey data and outtakes from the focus groups. Based on students' reasoning about the use of mobile phones in school, we use the notion of infrastructure as an analytical tool to understand the conflicts around the mobile phone in school. In the final section, we make some concluding remarks on the infrastructuring of the mobile phone in school.

2 Background

Mobile phones have become necessities to both adolescents and adults in all socioeconomic groups. In the lower income groups, the mobile phone is even the most common technological platform to own (Katz et al. 2014). This has had impact on school as well. Already years before the era of the smartphone, mobile phones were acknowledged as mediating usage both potentially beneficial and potentially destructive to school work (Sharples 2002). Benefits with banning have occasionally been presented in previous research (see e.g., Beland and Murphy 2015). However, research on mobile phones for learning has mainly focused on the technology's potentially beneficial impact on education and learning processes. Rather than studying mobile phones in mundane school practice, the studies carried out on the utilization of mobile phones for learning have often been experimental or quasi-experimental, promoting informal learning (Sung et al. 2016; Wu et al. 2012). In addition, there is research that has a more pragmatical approach to the mobile phone in formal education. This strand acknowledges the difficulties with the managing of mobile phones in school, but also the need for stakeholders to actively engage in the integration of this technology so important for students in their everyday lives. In the following section, we present research on various aspects of the perils, prospects, and pragmatic reasoning around mobile phones in school.

2.1 Perspectives on mobile phones in school settings

Research show that functions of the mobile phone, enabled by its connectivity and portability, which are appreciated in society outside of school, can enable cheating and disturbances in the education in school (Campbell 2006). American high-school students responded to a multi choice survey that they were disturbed by the ringing in school, and worried about the possibilities for cheating, cyberbullying and sexting mediated by the mobile phone (Thomas and Muñoz 2016). For the coping with students' use of mobile phones in school, there are research that argue for the abolishment of mobile phones in school. It has been suggested that the freedom to interact with the world outside of the classroom, that comes along with students' use of

their mobile phones in education, could cause too much reformational pressure on the traditional school organization for it to be permitted (Philip and Garcia 2015). Fear of changes in the traditional organization of teaching has been the motor when schools have formulated policies for banning as a means to handle the fact that students bring their mobile phones to school (Pachler et al. 2013). It has been argued that since students do not want to give up their mobile phones while being in class, any policy on banning mobile phones in college classrooms must be firmly enforced by the educators (Tindell and Bohlander 2012). However, teachers must be aware of risks with the enforcement of rules. In classrooms where there is a policy regulating the use of mobile phones, teachers must choose what is most disturbing during class: the confrontational enforcement of a prohibition, or the students' use of mobile phones (Berry and Westfall 2015). An undesirable consequence in classrooms where the mobile phone is strictly forbidden is that a student's use of the mobile phone can become an intentional subversive challenge of the teacher's authority (Kukulska-Hulme et al. 2009). This is a tension or conflict that could be mirroring the fact that students and teachers are viewing mobile phone usage in opposing ways (Garcia 2012; Lindberg et al. 2016). University faculty perceive mobile phones as more distractive and less appropriate to use in education than students do (Baker et al. 2012). Neither do Swedish upper secondary students seem to acknowledge the problems of mobile phones as being as severe as teachers do (Skolverket 2016a). In fact, it seems like students even in secondary school are actually rather aware of when to use and when not to use their mobile phones. Most often the mobile phones are used in between assignments, and neither teachers nor students do necessarily perceive them as nuisances (Olin-Scheller and Tanner 2015). In school environments where there are no structured pedagogical use of mobile phones, low achieving students' test scores seem to benefit from banning mobile phones. It appears that low-achieving students struggle more with self-control and distractions from mobile phones than high achieving students do (Beland and Murphy 2015). When encouraged to use the mobile phone as a tool for learning, college students do not necessarily find distractions mediated by the mobile phone to be an issue. On the contrary, students can feel that the mobile phone benefits their learning since its use can function as a motivational factor (Tessier 2013). Using the mobile phone in education can be a means for educators to make teaching and learning more authentic and personalized, and hence more relevant to adolescents (Roberson and Hagevik 2008). It has even been suggested that it is the responsibility of the faculty to design their teaching in accordance with the technology that students prefer (Baker et al. 2012).

Aspects of materiality have impact on the use of the mobile phones during class. Both students and teachers can perceive mobile phones, even when used in silence during class, as more disturbing than computers used in silence (Baker et al. 2012).

Sweden, as many other countries, has expanded the legislation (SFS 2010:800) allowing for teachers and schools to implement stricter rules to cope with the presence of mobile phones in school (Kukulska-Hulme et al. 2011; Ott 2014; Skolinspektionen 2016). However, the signals from the Swedish policymakers are ambiguous. They sanction schools to totally ban the use of mobile phones during school hours, and at the same time they state that mobile phones could be used in education (Skolinspektionen 2016; Skolverket 2016b).

With few exceptions, it is not until recently that the presence of the mobile phone in schools has started to be formally acknowledged as an opportunity to facilitate learning as part of movement towards a Bring Your Own Device (BYOD) approach (Thomas and Muñoz 2016; Skolverket 2016b). Research that acknowledges such practice, approaches the mobile phone more as a factor to be dealt with pragmatically.

College students are not unaware of difficulties with mobile phones in formal learning contexts. Students share the understanding that faculty have expressed: that mobile phones can be distractive in a school context. However, the students do not to the same extent consider those distractions to affect their academic performance (Berry and Westfall 2015). Reaching beyond the actors directly present in the physical school environment, parents can also be involved in both potentially supportive and distractive uses. Hence, there is a need for families to discuss appropriate mobile phone usage in and out of school (Keengwe et al. 2014). In addition, Katz et al. (2014) point to the fact that students in classrooms where mobile phones are banned still use their mobile phones for sending text messages during lessons. Instead, they suggest that a school culture that acknowledges technology utilization in their curriculums and defines rules and encourage technology appliance can in fact stimulate knowledge acquisition. In order to open up the classrooms to the potential of the mobile phone, students need to learn how to use their mobile phones for educational purposes, and educators need professional development (Humble-Thaden 2012; Pachler et al. 2009). No matter what the research regarding mobile phones in school suggests, the mobile phone has become an important resource in the universal service infrastructure. It has an impact on schooling, both when neglected and when adopted into practice.

3 Method

This study builds on data from a survey and focus groups interviews with upper secondary school students. The study was conducted with students from two schools in the west of Sweden, during the fall and winter of 2015–2016. One of the schools was situated in a midsized city and the other was situated in a larger city. We began by conducting a survey with over 200 students, which was then used as a guide in selecting the sample for four focus group interviews. In the following, we describe the details of this process.

3.1 The survey

The intended sample of students for the focus groups, was guided by the questionnaire (N = 206, response rate 100%) to contain students with diverse perceptions of mobile phones in school, including an equal distribution over the school years, gender, and user type (Table 1). The questionnaire measured how much the students used their mobile phones for school work in school (response alternatives were: *never*, *at least once per month*, *1–3 times per week*, *more than 3 times per week*, and *daily*. For the analysis, the categories *1–3 times per week* and *more than 3 times per week* have been merged into the category *weekly*). The students were also asked to in text describe perceived hindrances for mobile phone use in school. The students voluntarily responded to the questionnaire online, during a lesson three - four months before the focus group interviews.

Table 1 Comparison of background data between the population and the sampled focus groups

		Questionnaire respondents $N = 206$	Focus group participants $n = 19$ (except for User type $n = 17$)
Gender	male	55,3%	52,6%
	female	43,2%	47,3%
	other	1,5	0%
Mobile phone	smartphones	99%	100%
	basic mobile phone	1%	0%
Bring the mobile phone to school everyday	yes	98,5%	100%
	no	1,5%	0%
User type	Beginner[a]	0,5%	0%
	Normal[a]	17%	17,6%
	Habitual[a]	60,7%	58,8%
	Expert user[a]	21,8%	23,5%

[a] Beginner: I need a lot of help when I am using digital technology; Normal user: I manage well on my own; Habitual user: I can do most things, and what I cannot do, I can learn on my own; Expert user: I know most things and a little extra (Haglind 2013)

3.2 The focus group interviews

The focus group interviews were semi-structured, guided by a moderator using an interview guide with open-ended questions to support the discussion (Halkier and Torhell 2010; Morgan 1997; Wibeck 2001). The questions in the interview guide were:

- Which are the rules concerning mobile phones in your school?
- Should students be allowed to use their mobile phones in school?
- How do you use your mobile phones for school work in school and at home?
- What impact have mobile phones had on your school work achievements, perceived benefits/disadvantages?
- What do your parents think about your use of mobile phones in school and at home?

Prior to the focus group interviews, the participants were asked to read a newspaper column authored by a Swedish media personality (Schulman 2015) as a stimulus material to provoke discussion. The author of the column is clearly arguing in favour of banning mobile phones from schools in general, not only from classrooms. The column was chosen since it mirrors the typical debate on mobile phones in Swedish schools in Swedish newspaper articles (cf. Ott 2014). The author's arguments could potentially have influenced the discussions in the focus groups. However, the aim of using a stimulus material in this study was to get the students to respond to the ongoing debate, and the results should be understood as students responding to the discussion around what to make of the mobile phone in school.

3.3 The sample

The night before one of the days appointed for two of the focus group sessions, a blizzard hit one of the cities and hindered the students to come to school. Therefore, the intended sample had to be extended by additional students that were recruited voluntarily at the last minute. Consequently, the study is partly build on a convenience sample (Cohen et al. 2013). However, the final sample was still representative for the population (Table 1). Of the students participating in the focus groups, two participants were absent when the questionnaire was distributed, hence there is no data regarding self-assessed user type for two of the participants. The rest of the background data could be gathered from those two participants' statements during the focus group interviews.

The participants (n = 19) were distributed differently between the focus groups (Table 2). Focus groups #1, #2 and #3 contained members with different ages and from different classes but the same school. In focus group #4, the participants were all classmates in the last year.

A couple of weeks before each focus group session the participants were informed about the purpose of the study. The participants in the focus groups were all in the ages between 16 and 19 years, and therefore old enough to give their written informed consent to their voluntary participation in the study. The research followed the ethical codex of the Swedish research council (Vetenskapsrådet 2011), and the empirical data has been treated accordingly. All focus groups were audio-recorded. Focus group #1 and #2 were also documented by an additional researcher taking notes.

The recordings have been transcribed in full. The audio-recordings, the transcriptions and the notes taken by the additional researcher during focus groups #1 and #2, have been actively listened to and read through repeatedly. The transcribed data was analyzed using a qualitative, thematic analysis (Wilkinson 2011) searching for patterns and variations in the students' narratives of their managing of mobile phones. Excerpts of the transcription that could be classified into emerging categories were selected. These categories were: tools, students, learning objectives, rules, community, roles of teachers and students. For the visualization of potential patterns, the selected excerpts were then pinned up on a wall, category by category. In this process four broad themes emerged: the role of the mobile phone in the students' lives, reasoning around the mobile phone in classroom practice, negotiating the use of a potentially distractive and disturbing technology, and reasoning around prohibition.

For the analysis, selected survey data and a synthesis of the four focus groups are discussed. To illustrate especially significant findings, we use anonymized excerpts (Exc) from the focus groups. All excerpts presented in the result section have been translated from the transcribed Swedish verbatim to English, by the native Swedish speaking authors.

Table 2 Distribution of participants in the four focus groups

Focus group	#1	#2	#3	#4
Participants	3	6	4	6

4 Results and discussion

This study examines Swedish upper secondary students own reasoning about the usage of mobile phones in school. Since our data is generated from students' own narratives, we cannot make any certain conclusions of how mobile phones are actually used in school practice. However, students can be quite accurate in their self-rating of both their on-task and off-task use of potentially distractive technology in education (Ragan et al. 2014).

The students' narratives on their usage of mobile phones in school display that the students can reason around both potential benefits of mobile phone use in school and potential disadvantages of the same. The students acknowledge that out-side of school their mobile phones ubiquitously enable numerous of activities, and services in their day-to-day life. The students also describe how they in school use their mobile phones for school relevant work on many occasions, regardless of the current local policy in school. This means that students are actors in the boundary between the universal service infrastructure and the infrastructure for learning manifested through teachers, legislation and local policy.

In this section, we present data from the survey and the focus groups. With the notion of infrastructure for learning (Guribye and Lindström 2009) we discuss the social and technological dimensions of students' use of the mobile phone. We will first present and discuss: the role mobile phones play in the everyday life of the students', then; how the students perceive mobile phones and their use in school, after that; students' positions in the implicit negotiations of mobile phones into the infrastructure for learning, and finally; reasoning around prohibition.

4.1 The role of the mobile phone in students' lives

In all four focus groups the most distinctive properties of the mobile phone that emerged were its mobility, connectivity, and ubiquity. The use of the mobile phone enhanced the students' own mobility, flexibility, and individuality both in school and at home. In the focus groups, all of the students stated that they occasionally used the mobile phone for school work in school to some extent. The results from the survey also support that the mobile phone was regularly used by the students in the schools for a number of school related uses, according to their own statements (Table 3).

In comparison to the statistical data, focus group interviews can provide insights into the sources of complex behaviours and motivations (Halkier and Torhell 2010; Morgan 1997; Wibeck 2001). In the focus groups, some students stated that they used the mobile phone just to check the time or the schedule, while other students used it for more advanced purposes. School related uses of the mobile phone were of broad range: accessing the school's learning management system, the possibility of browsing for information, calculation, translation of words, note taking when not having a notebook, or organization of the school day, for example through the use of the calendar and social media groups. The mobile phone was also used for leisure activities in school, such as listening to music, browsing for information, gaming, entertainment, communication and social media. As one of the students summarized the use of the mobile phone, it was used 'for most things' (Henry, #1).

Table 3 Students use of mobile phones for school work in school (%)

n = 187	Never	Monthly	Weekly	Daily
Cooperation with classmates by social media	8	11	23	57
Translation of words	12	12	25	51
Editing picture and sound	9	18	27	45
Connecting the computer to the Internet	15	24	25	35
Recording picture and sound	23	27	17	33
Looking at pictures	36	20	24	21
Cooperation with classmates by phone or video call	36	24	18	21
Taking photos for school assignments	28	35	19	18
Reading lesson notes	37	31	16	16
Writing texts for school assignments	40	28	18	15
Browsing the Internet for information	49	21	14	15
Using the calculator app	50	24	12	15
Communication with teachers	53	20	13	14
Accessing material produced by the teacher	59	24	7	11
Accessing the LMS	66	17	9	8
Cooperation with classmates by text	75	12	8	6
Looking at information films on the Internet	71	16	8	5

The students gave several accounts that the mobile phone was with them everywhere, anytime, and, this of course includes school. While sleeping, they kept the mobile phone by the side of their bed. One student stated that no matter if she used her mobile phone or not, the mere awareness of having it available made her happy (Elsa #2). Being constantly reachable was described by students as providing them with a sense of personal security. One of the most common arguments for having a mobile phone in school was that the mobile phone made it possible for their parents to stay in touch with them during the school day. However, since the students were aware of the conflicts regarding their access to and use of mobile phones during school hours, such an argument could be an expression of students' knowledge of valid arguments to motivate their access to the mobile phone while being in class.

Drawing from the data, we argue that it is fair to say that mobile phones are resources in students' universal service infrastructure. The mobile phone is also the portal node to the social networks where much of students' socializing are taking place (Veyrat et al. 2008). Elsa (#2) and Jennifer (#3) even described themselves as to some degree addicted to their mobile phones, and being without the mobile phone was not an option. Addiction to mobile phones has also been reflected in research (Samaha and Hawi 2016). From the infrastructural perspective, this addiction like condition following in the deprivation of the mobile phone can be understood as a breakdown in the infrastructure that they depend on. That breakdown makes the students aware of the devices' significance for their social life and ultimately for their well-being.

4.2 Reasoning around the mobile phone in classroom practice

In the focus group discussions, most students described that the mobile phone had positively influenced their education. However, the students did also talk of pitfalls and situations when the mobile phone was used for other purposes than school work. It appears that such distractive utilization was specifically tempting when the education was perceived as boring, not demanding enough, uninteresting, or when a student got stuck and had to await the teacher's assistance. The students' narratives align with what Olin-Scheller and Tanner (2015) conclude from observing secondary students; the mobile phones are used in the gaps between different school assignments. The students in the focus group described that at those times they routinely picked up the mobile phone, and did not always manage to get back to school work again. However, as an argument to support the access of mobile phones despite the distractions, the students acknowledged that before there were mobile phones in the classroom the gaps in the school work could be triggers to other kinds of disturbing behaviour, for example yelling and talking in class. That did still occur, and two students admitted that there could be a lot of talking in the classroom, even more so when the mobile phones were not at hand.

Exc:1

Maria: If people are sitting with their mobiles it is often totally quiet.

Anna: Yes, because then everyone is sitting and looking in the mobile, and then you don't really disturb anyone. (#3)

Distractive behaviour and lecture resistance are no new phenomena that were introduced into the classroom by the mobile phone. Rather the distractions mediated through the mobile phone in the classroom continue as an ordinary, yet disturbing tradition of school practice (Hassoun 2015). But as Maria and Anna (see Exc:1) suggest, on a collective level use of mobile phones do not necessarily disturb, but instead can calm down the classroom environment. The possibility to gain focus by shutting out turmoil from a noisy environment by listening to music, is one example of an appreciated feature. Another appreciated feature was the camera. On some occasions, the students stated that teachers could encourage them to use their mobile phones to take a photo of the white board. When using the music player or the camera to support learning, the use of the mobile phone has been assigned with a pedagogical purpose. In that moment, the mobile phone is becoming a resource in the infrastructure for learning, and the students' narratives presented more examples of when the mobile phone was used to benefit the school work.

Some students claimed that they had already started to develop uses of the mobile phone that were being supportive of learning in school. These students meant that they could regulate their use of the mobile phone in accordance with what they perceived as accepted behaviour. The students also described their use as being supportive to their school work when the mobile phone was used as a means to move further when being stuck. In those situations, the mobile phone mediated input that assisted the students to re-engage in the school work, and to remain active in their learning. Authenticity of

(Roberson and Hagevik 2008), and motivation for- and involvement in learning (Tessier 2013) have been beneficial aspects put forth in research regarding mobile phones in education.

> Exc:2
>
> Jenny: I think we learn very much from having the phone available, so that we can browse for things and if we get to a discussion it might be standing still for all of us. No one has any answer, then Tyrone can browse for the answer and the we can sort of, uhu, then new ideas sort of grow to all of us, like ok, uhu! (#4)

This practice was generally initiated by the students themselves and involved the use of external sources of information (online), collaborations through social media and the opportunity to engage in school work independent of the physical or temporal circumstances. This could not have been possible in a classroom where the mobile phones would have been kept away from the students by the teacher. These situations could be considered from a socio-cultural perspective as gateways to the zone of proximal development (Vygotsky 1978) by providing the required support for the students' development. When the students had reached as far as they could on their own, they turned to the teacher for assistance to continue their learning. Since students shared their teacher with the rest of the class, they had only limited access to their teacher. As Ragan et al. (2014) suggests, students instead of waiting to be assisted by the teacher, use technology to access additional information. When students in the focus groups do this, they develop their own personal infrastructures for learning, in which the ubiquity of the mobile phone enables new learning practices. These practices challenge the teacher's role as a source of knowledge in the infrastructure for learning.

4.3 Negotiating the use of a potentially distractive and disturbing technology

The mobile phones' presence in the infrastructure for learning in school is bound to have impact on the practice enabled by the infrastructure. That impact has often been perceived as disturbing and distractive. To the students, it was not so much the mobile phone in itself that disturbed the education. What was disturbing depended on in what manner, for what purpose and in which context, the mobile phones were used. The students' responses to the open-ended questions, in the survey, concerning their perceptions of hindrances for using the mobile phone for school work show that the perceived hindrances can be organized into four main categories: distractions, which the use of social media, gaming and texting are all variations of; the teacher; limitations with the software or hardware of the mobile phone, and the fourth category of seeing no hindrances. The responses varied between just a word "the teacher" to full sentences of reasoning: "That the teacher thinks that you do anything but school work. I mean that you are texting when you are taking notes related to school work". Worth noticing is that suggested problems with sexting and cyberbullying (Thomas and Muñoz 2016) was not mentioned in the students' responses. Cheating was mentioned once, but in the context of teachers wrongfully believing that the students were cheating. Table 4 shows the frequency of responses that could be classified into the emerging categories.

Table 4 Frequency of students mentioned hindrances for using the mobile phone for school work in school

Hindrances (n = 212)	Number of mentions
Distractions (Social media, gaming & texting)	109
The teacher	43
Technological limitations	26
No hindrances	16

For the individual student to be able to relate to the mobile phone without being distracted by the functions it enables, some of the students in the focus groups suggested that school and parents need to educate the new generations of mobile phone using students in appropriate ways of using the mobile phone for learning in school. Teaching appropriate ways of use was expressed as preferred over prohibition of the mobile phone.

Exc:3

Olga: But if you learn from an early stage not to do it and to stay focused on the work. And when you use your mobile you don't use it for social media. If you learn that, that way, I don't think that there will be any problems. You, you get it in early that you have to adjust to the environment and the technology that exist there today. (#1)

[...]

Efraim: As said before, it is better to just take what you've got and make something positive from it. (Olga: Yes.) And sort of, start from the beginning and learn from that you are small, that you absolutely shall not do it. You transform it to a positive thing. That it helps the school subjects that you browse for information instead. And maybe create more digital learning resources. (#1)

The students did not talk of infrastructure, but what they suggested was the formal integration of the mobile phone to school's infrastructure for learning. However, all students did not agree. In the focus groups, there were diverse opinions on what was seen as responsible mobile phone usage and what was potentially distractive and disturbing usage. During lectures, it seems that the problem with distractions were more urgent than during school assignments carried out individually or in groups. The students generally described that it was impolite to the teacher to use the mobile phone during lectures, even if it was beneficial to the student's own learning. As a student, you are supposed to pay respect and listen to the teacher, who is a lesser contested (social) resource in the infrastructure for learning. However, this opinion was divided. Some students claimed that when they used their mobile phone during class and lectures they were browsing for extra information on the topic that the teacher was lecturing on. These students did not think that they were acting disrespectfully. However, the teacher was not an uncontested authority. One thing that was certainly perceived as disturbing was when the teacher interrupted the lecture to tell a classmate who was looking at the mobile phone to put it away.

Exc:4

Sam: There are always some students who have a tendency to take out the mobile, and always be told by the teacher. And even if it doesn't matter that much that the teacher tells them of for a second, it kind of disturbs the lecture. That is disturbing.

Tim: But I don't understand, if it is muted and this person is sitting and ignoring the teacher, well it (the teacher) can find it difficult but I still believe that it (the teacher) should be able to hold a lecture, without to having to tell a student that the student is fidgeting with the mobile.

Sam: Well, I still think it is disrespectful not to pay attention to the teacher. (#4)

From Sam's reasoning, it became clear that even when the mobile phone usage was driven by interest for school work it could be perceived as disturbing. Cultural values of school and technology have a high impact (Pachler et al. 2009), and from the focus groups there is no unilateral response to be found, to what responsible usage is.

One example where the aspects of materiality discussed by Baker et al. (2012) is active is in the students' discussions of the relation between computers and mobile phones. When the schools' computers were not functioning for some reason, the students could use their mobile phones instead, as a back-up resource to support their school work. Sometimes they were even encouraged by their teachers to do so. However, since they did not want to be regarded as disobedient, the students were cautious when using the mobile phone on their own initiative. Despite the fact that some teachers encouraged them to use the mobile phone, the students in both the focus groups and the survey (Table 4), described how teachers intuitively would make the assumption that when a student was using a mobile phone in class, the student was not occupied with school work. Referring to the stimulus material the students did not believe that adults could really relate to the situation of the youth and their utilization of the mobile phone, and regarded it as 'some kind of a toy' (Eric #2).

Exc:5

Keith: When the teacher sees a mobile they think you do something completely different, but with a computer they always just think that you are taking notes. (#4)

Some students agreed with teachers' understanding that the mobile phone was used for leisure activities rather than for learning: 'I think that, in school, you are not there to fidget with your mobile, you are there to learn' (Sam: #4). However, that statement could also be a reflection of this particular student's personal struggle with his mobile phone usage in school and at home.

The interaction among the students participating in the focus groups can produce insights and data that would most likely not be obtained as efficiently with other types of research methods (Morgan 1997). An example of this was when the students in focus group #4 engaged in an extended discussion on whether computers are used only for

school work during the lessons, it turned out that computers also are used for activities that are not school work related. The discussion ends with the following sequence:

Exc:6

Tim: But should we ban computers then as well you mean?

Sam: No, but computers are most often used as a sort of tool for taking notes. A mobile could be that as well, but it is not many who do that. (#4)

It was not only the mobile phone but also computers that were appointed as being potentially destructive to the school work. It seems that the problematic materiality of the mobile phone is related to the connectivity of the technology. Which is even more evident from another student's statement on the possibility to integrate mobile phones to school practice.

Exc:7

Vivianne: [...] If we should start to do school work with the mobile phones? I don't think that is a good idea.

Moderator: Why not?

Vivianne: In my classes, I see people looking at YouTube on the computers every day. And then they are falling behind in every subject (#3).

Vivianne acknowledges that when her peers had access to technology that was connected to the Internet they were not able to take responsibility for their schoolwork. However, the specific problem of misuse was more associated with the mobile phone than with the computer. As a technology without a formal purpose in the schools' infrastructure for learning the mobile phone holds the potential of being futile to the ongoing practice enabled by the accepted infrastructure of learning (Guribye 2005). In the present study, none of the two schools did formally encourage any educational use of mobile phones. In fact, the students at both schools expressed an ambivalence on the existence of a particular policy at their own school. Nevertheless, the students perceived the existence of some implicit guidelines for the use of mobile phones in school. One student summarized the core of the implicit guidelines after a brief discussion: 'It must not disturb; it is as simple as that' (Eric #2).

4.4 Reasoning about prohibition

From the focus group interviews it appears that the students believed that their teachers were generally opposing the mobile phone in the classroom, as they perceived the mobile phone as destructive for education. This was a belief that was shared by many of the students who pointed to the need for some rules regarding the mobile phone in the classroom. As social resources in the infrastructure for learning the local policies did not seem to be clear enough to wholly enable the practices it should enable

throughout the infrastructure for learning. The students described a present situation where different teachers had different rules for the use of the mobile phone during lessons. There were individual teachers that sometimes encouraged the students to use their mobile phones during lessons, mostly for browsing for information. At one of the schools, some of the teachers occasionally collected the students' mobile phones at the beginning of the lesson and kept them in a special container at the teacher's desk throughout the class. According to the students, that was because those teachers felt there were too much disturbances with mobile phones available to the students. The students had mixed feelings about giving their mobile phones away. Some students stated that they could stay better focused on school work during lessons when their mobile phones were kept at the teacher's desk. However, the students acknowledged that even when the teacher asked them to hand in their mobile phones, all of their peers did not do it. Some students also expressed that the collection of the mobile phones was an unnecessary act. Since it sometimes could happen that the very same teacher who had collected the mobile phones at the beginning of the class, later on, during the same lesson encouraged the students to use their mobile phones in connection to a school work related task. Despite that extra struggle, the students expressed more acceptance towards the teacher's collection of the mobile phone, than towards confiscation, which they did not think was motivated. The students in the focus groups had occasionally experienced having their mobile phone confiscated by teachers, and the students could generally comprehend why they had gotten their mobile phone confiscated. However, the consequences of outstepping the rules were not as appreciated, and if a teacher wants to achieve increased focus from the students on schoolwork, confiscation of mobile phones might even have the opposite effect, as one student described her experience of having her mobile phone confiscated:

Exc:8

Elizabeth: [...] if you consider that they confiscate the mobile from you, the only thing you will think about is the mobile. It is better to have it next to you, then you can concentrate better. (#2)

Confiscation as a response to individual students' use of the mobile phone was not always carried out individually by the teachers. Sometimes confiscation was carried out collectively in the whole class. Those occasions were specifically aggravating. When teachers collected the obedient students' mobile phones, which they sometimes used for school work, before or during the lesson the students were disturbed by having their infrastructure for learning sabotaged by this somewhat arbitrary enforcement of rules. Some students stated that it sometimes seemed as if their peers thought of it as a personal right to have the mobile phone available during classes. When mobile phones were regarded as private property confiscation was perceived as extra problematic.

Exc:9

Luke: [...] you can't ban them, that's how it is. A mobile is someone's property and there could be several reasons for why someone brings it to class. And if it's banned then it will always be those who refuse to obey to the regulation. So, it

> will be just another issue with the mobiles. You could have more strictly regulation, if you misuse it, it will be taken from you, but otherwise, I don't support a complete ban of it. (#2)

The appreciation of the regulation was expressed differently in the different focus groups. Generally, the students supported some kind of regulation. As it is indicated from Luke's statement in the excerpt above, it is difficult to see how such regulation would be designed to meet both the conditions of the right for the students to have their privacy and be in control of their belongings, and the possibility for the teachers to ban the use of the mobile phones. From the students' narratives, there seem to be no universal solutions. Overall the students believed that using the mobile phone was a personal matter. The students pointed to the individual student's own responsibility for his or her own educational achievements. The students were not in unison agreeing on how to responsibly use the mobile phones in class. They all expressed that it was not acceptable to use the mobile phone in a manner that disturbed anyone. However, what was perceived as disturbing varied, and the students' sensitivity to disturbances varied. One student described that the screen light of classmates' mobile phones could be disturbing (Sam #4). Another student stated that it was more so the classmates' whispering to each other while looking at the mobile phone that was distracting (Efraim #1).

In addition to disturbances in the classroom the interaction with the outside world was potentially distractive. In the survey, and even more so in the focus group discussions about potential distractions, social media was the most recurring topic. Social media was often the reason why the mobile phone was used for leisure activities rather than school work during class. As the main distractions students mentioned Facebook, Instagram and Snapchat, of which the latter involved making faces which also attracted the attention of their co-located peers, for instance during student presentations.

Exc:10

> John: If you see someone that sits and raises their eyebrows and open their mouth to activate the Snapchat filter, then it is, it bothers you, then I lose my focus (#4).

A particularly difficult struggle for the students to handle were the temptations provided by notifications from social media and applications. All the students knew that they could turn the notifications off. But at the same time, if they did not respond to an event they felt that they might miss out on something important within their social network of friends. The students wanted to stay updated, and be included socially. Hence, it was difficult for the students to postpone their responses to their friends.

To summarize, based on the students' narratives, the influx of content which was not related to school work through social media was difficult to handle for the students during school hours. The students were aware that the use of mobile phones in the class could be destructive, but at the same time they did, with some exceptions, believe that their education had mostly benefitted from the use of mobile phones. The students voiced a discrepancy between their own and the adults' conceptualization of mobile

phones. The students did not believe that adults understood that mobile phones in the hands of the students could be useful for school work. They generally regarded the use of mobile phones to be a personal matter, where each and every one had an own responsibility to not let their usage disturb the rest of the class. They did not support banning of the mobile phone, but appreciated some guidelines for their handling of the devices during class. School work and leisure activities often relied on the same infrastructure. For example, social media was generally associated with leisure, but the students also used social media groups to communicate with peers about school work and to organize study groups based on the class or course. Listening to music was not only a leisure activity, in school it could also be a means to seal out distractions and help the students to concentrate.

5 Concluding remarks

Using the notion of infrastructure opens up the dynamics and complexity of the social and technological arrangements that enable social practice (Bowker and Star 1999; Guribye 2015). Infrastructures are not static, they grow (Star and Bowker 2006). Development and maintenance of infrastructure, are social processes in which the infrastructure's components through the use of them are negotiated and established (Bygholm and Nyvang 2009). Based on the findings from the survey and the focus group interviews with upper secondary students we argue that, BYOD is no longer a choice to make for pioneering schools. Students have in fact *already brought* their own devices to school. In contrast to other technologies which are established and accepted resources of school's infrastructure for learning, mobile phones are not distributed and supported by schools. However, the students describe that they and their teachers engage in daily negotiations on the use of the devices for school work.

When students are merging their universal service infrastructure and the infrastructure for learning of school, they are to some extent adapting their regular use of mobile phones to the norms of school practice. At the same time the use of the mobile phone in school opens a boundary space between school work and leisure activities. When the mobile phone becomes more intertwined in students' everyday life and school work it is a call for new solutions to handle the mobile phone in a responsible way. The integration of technology to an infrastructure can be facilitated by careful planning, and an awareness of that the new technology inevitably will impact the practices enabled by current infrastructure for learning (Guribye 2005). Therefore, there is a need to have an informed discussion of how to handle the mobile phone in school in order to get school work done. The mere understanding of an implicit policy does not seem to be enough to guide the management of the use of mobile phones in the classroom. At present, the teachers keep on confiscating mobile phones and the students keep on using them for all sorts of actions, school related and not school related. This circular play-out of actions holds the potential to lead to a continuing situation of unstructured use and unstructured enforcement of individual policy, from which no one involved benefits. Since the mobile phone is present in classrooms, Berry and Westfall (2015) suggest that the main figure of the discussion should be integration rather than prohibition of the technology. We argue that such a discussion should also include parents. Since parents are important for students to succeed in school (Statens medieråd 2016), they need to understand the

conditions under which their children work. The students did express a concern for the younger generation's use of the mobile phone, and they suggested that there might be a need for some kind of training in order to be able to use the mobile phones in a way that supports learning. Kolb (2008) suggests a social contract between educators and students on how to use the mobile phone. Drawing on the student perspective we argue that this sort of contract could be a social resource in the infrastructuring of mobile phones in upper secondary school. Both students and teachers have to be formally supported in crossing the boundary between school work and leisure activities, that would eventually facilitate the work of infrastructuring (Star and Bowker 2006; Pipek and Wulf 2009) the mobile phone in school practice. As we have shown, the presence of mobile phones in school challenges the school's infrastructure for learning, at the same time the mobile phone has become a resource in the student's infrastructure for learning.

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