DEPARTMENT OF EDUCATION, COMMUNICATION & LEARNING

TEACHERS' AND STUDENTS' PERCEIVED POSSIBILITIES AND CHALLENGES AS STRUCTURING RESOURCES IN THE DIGITAL CLASSROOM

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Abstract

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Purpose: The overall purpose of this study is to explore possibilities and challenges in the digital classroom of a secondary school. More specifically the focus is on teachers' and students' perceived possibilities and challenges in classroom activities that are mediated by digital tools and what becomes significant structuring recourses in this interaction.

Theory: A sociocultural perspective of learning has functioned as a basis for this study in the analysis of the various aspects in activities with digital tools, put forward by the teachers and students in the interviews. These aspects are analysed in terms of what becomes significant structuring recourses for the teachers' and students' work in the classroom activities. The concept *structuring resource* is here defined as everything in the context that is made use of when people act in situations.

Method: A case study method is used in this research. The main empirical data consists of recorded semi-structured interviews that were generated at a secondary school in Sweden, which were transcribed. To serve as background data, unstructured observations were also conducted. A thematic analysis was employed to work with the data.

Results: Findings from this study reveal several possibilities and challenges in a digital classroom. By means of thematic analysis some of the aspects that appear as structuring resources for the students and the teachers were shown. Perceived possibilities were organizing learning, supportive opportunities for the teacher, and possibilities with the subject specific teaching material. Perceived challenges were technical problems, decreased learning opportunities, difficulties for the teacher, and challenges with the subject specific teaching material. As has been suggested in previous research, the teachers' scaffolding can be seen as a main structuring resource for students' classroom activities, but the digital tools also provide structuring resources in terms of positive aspects as for example individualization, information gathering, accessibility and more negative aspects in terms of distraction.

Foreword

I would like to thank all students who have participated in interviews and observations during this research. A special thanks to the assistant principle and the two teachers for letting me spend time at the school and in your classrooms. Your input, ideas and time is greatly valued.

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1. Introduction

Information Technology (IT) has affected and transformed most aspects of our lives during the last decades. We now need to be able to navigate in a digital world to be able to fully take part in western societies. Due to this, schools are expected to educate students in becoming digitally competent, which according to a definition by OECD refers to the confident and critical usage of digital technologies for information, communication and basic problem-solving in all aspects of life (Ananiadou & Claro, 2009). This implies a challenge for education. To meet these changed conditions, the Swedish government has in October 2017 accepted a national digitalization strategy for the educational system (Utbildningsdepartementet, 2017), and acknowledged a national action plan in March this year called #skolDigiplan to meet this strategy (Sveriges kommuner och landsting, 2019).

A report by Internetstiftelsen (2017) shows that two years ago, 97 % of Swedish secondary school students had access to a digital device at school, either a personal computer, tablet or a class collection of devices. One can only assume that that number has not been reduced and that a majority of school work today is performed on digital devices. It is crucial that school leaders and teachers get the right means to reach digitalization strategies, rather than being equipped with resources that they cannot utilize properly. Despite political decisions and detailed policies, not much research demonstrates a positive impact on students' learning outcomes where computers are used in education. For example, a study from OECD based on results from PISA shows that impact on student performance when computers are used in the classroom is inconsiderable (Peña-López, 2015). School leaders, teachers and students thus need competence in what digital hardware and software to use and how to use them for enhanced learning outcomes.

In media debates, another picture emerges, where groups in the society are upset and reluctant towards what is happening in the digitalized classroom. In Swedish media, there is an ever so agitated debate whether education is being enhanced or harmed by IT. One recent example is that loud voices have been raised to forbid mobile phone use in schools and in January 2019, the Swedish government proposed a mobile phone prohibition in schools (Olsson, 2019). Others encourage a movement where all students have their own device and are constantly connected. Teachers are often positioned in the middle of this, with obligations to follow top-down decisions and dealing with confused students. While various stakeholders hold strong opinions, this study is turned towards the most important stakeholders, those who are exposed to and experience educational IT every day, namely the teachers and the students. Therefore, this thesis examines how digital tools are utilized in the classroom and both what kinds of possibilities and challenges students and teachers consider to be involved in their work with digital devices.

In the literature, several advantages are discussed as inherent in digital tools and digital teaching material. For instance, researchers present prospects of increased motivation, possibilities for collaboration and unburdened human cognitive resources through interaction with digital tools (e.g. Guðmundsdóttir, Dalaaker, Egeberg, Hatlevik & Tømte, 2014). This requires that students and teachers know how to utilize the resources and exercise them in appropriate ways. Several other studies do not solely promote the digitalization but also invoke various challenges. These challenges include distraction, increased individual work and teachers' need for competence development to enhance their digital proficiency (e.g.

Grönlund & Wiklund, 2018; Kontkanen, Dillon, Valtonen, Eronen, Koskela & Väisänen, 2016). As a theoretical base, this thesis applies a sociocultural perspective of learning. The empirical data is collected by interviewing and observing students and teachers in a secondary school in Sweden. More specifically the context of the empirical study is three classrooms; one ninth-grade English class and two seventh-grade social science classes and the main empirical data consists of semi-structured interviews with the students and the teachers. By exploring how students and teachers express the interaction with the digital tools the focus is on their assumptions of possibilities and challenges in the activities. In an analytic sense, both the possibilities and their ways of dealing with the challenges could be understood as *structuring resources*[1] that support their activities in the classroom context.

1.1 Aim and research questions

The overall aim of this study is to explore possibilities and challenges in the digital classrooms of a secondary school. More specifically the research will explore teachers' and students' perceived possibilities and challenges in learning activities mediated by digital tools, with the analytical focus to examine what becomes significant structuring recourses in this practice.

The following research questions have guided the study:

- What possibilities and challenges do teachers and students consider to emerge in the classroom when the activities are mediated by digital tools?
- What could be seen as significant *structuring recourses* for the work in the digital classroom?

1.2 Definitions

In this thesis, terms such as digital teaching material, and digital tools are frequently used. Digital teaching material is here limited to programs, apps and other material developed for educational use and for students' learning processes with content that has clear connections to curricula or other regulatory documents. Digital tools is here used as a slightly wider concept than including only devices. Digital tools include software as well as hardware, and can hence be an application, a game or a robot. A digital classroom implies a classroom where digital tools are utilized, for example where the students use digital devices.

Terms that are frequently used in the literature are ICT, educational ICT, technology supported learning and digital learning, but in this thesis educational IT or simply IT will be used as an umbrella term to describe contexts where digital tools are exploited for educational purposes.

1.3 Outline of the thesis

This thesis starts with a chapter describing the theoretical perspective that underpins the study. This is followed by previous research, where relevant literature in the field of IT and learning is presented. After this follows the method chapter, presenting the setting of the study, the choice of method, and the study itself. In the findings chapter, the results of the empirical study are presented and thereafter analyzed. In the following discussion chapter, findings from the collected data are discussed in comparison with previous research. Limitations and future research are also presented in the discussion chapter. Finally, in the last chapter conclusions and implications from this master thesis are presented.

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[1] This concept will be elaborated on in the Theory chapter

2. Theoretical perspective

This chapter presents an introduction to the sociocultural perspective of learning that underpins this study of teachers' and students' considerations of possibilities and challenges in digital classrooms of a secondary school. Furthermore, brief discussions of the concepts mediating tools and structuring resources are presented.

2.1 Sociocultural perspective of learning

This study is underpinned by the sociocultural perspective of learning that derives from Lev Vygotsky's original work. However, in this study later scholars, such as Roger Säljö (2010), that have involved digital technologies and their implications for education will be used. From a sociocultural perspective mental processes are not understood as existing in a vacuum but are always relative to demands and opportunities in the surroundings (Säljö, 2011). The fundamental thoughts in a sociocultural perspective of learning is that knowledge is not only something existing within individuals, but rather among or between people (Säljö, 2011). Knowledge is developed and mastered through interaction between humans who are trying to coordinate their perspective and handle situations collectively, hence the origin of knowledge is in the interaction. Knowledge should consequently be viewed as something that comes to life and gains meaning in the interaction between humans (Säljö, 2011). A central matter is trying to view different activities in the society from a learning perspective, and to understand interactions between collectives, individuals, and resources. Interactivity as a concept concerns cooperation, interplay, or some kind of exchange between two or more actors. This allows for two possible interpretations. It can either be an interaction between a human and a machine or as communication and exchange between humans (Severin & Tankard, 2001). Interaction between humans also includes an extensive image of communication, which may be supported by different kinds of IT. Interactivity is, hence, frequently used as a concept when communication is carried out with or through digital tools. It can be recognized as a technological feature of mediated surroundings where people interact with technology or with other people through technology (Bucy & Tao, 2007). Consequently, from a sociocultural perspective, learning is not merely focused on gathering knowledge and skills, but rather on individuals taking part of learning through conversations and discussions and by interacting with tools (Säljö, 2011). Our knowledge is expressed in our capacities to collaborate with the external tools and to merge them into what we are doing (Säljö, 2010).

From a sociocultural perspective learning is also understood as situated, i.e. as a social process embedded within activity, context and culture (Säljö, 2005). The idea of situated learning implies that social interaction can promote learning and learners' collaborating and solving real-life problems reflects situated learning (West, 2017). Participation in social practices is a fundamental mechanism for driving development of knowledgeable skills (DeVane, 2010). Hence, memberships in social practices are essential to a person's learning trajectory. Vygotsky described learning as situated in practical activities and as achieved through participants' increasing appropriation of psychological and technical tools. This means that we do not encounter the world in a neutral, objective and direct manner; rather, we learn to interact with objects and people by means of signs and tools such as written and spoken language and different artefacts that are relevant to the purposes of specific social practices. Social interaction, communication and collaboration are seen to be essential components. Säljö (2010) reflects on relationships between learning and digital technologies. Digital technological resources, that have the capacity to store, access, and manipulate

information, are argued to increase the pressure of learning activities. Technologies transform both how we learn, and how we interpret learning. Brown, Collins and Duguid (1989) discuss this by claiming that people who actively rather than passively use tools build rich understandings of the world in which the tool is used and also of the tool itself.

2.1.1 Mediating tools

Higher mental processes are in the sociocultural perspective seen as functioning of mediated activities (Vygotsky, cited in Säljö, 2005). Mediated action is a fundamental concept in the sociocultural view of learning, which includes interactions between individuals, artefacts and tools to attain an outcome (Schuh, Van Horne & Russell, 2018). What is learned is thus mediated by various tools. Mediation means that humans interact with external tools, which serve as external resources to for example act and to remember something. By using external tools, we are reshaping learning processes that help us act in complex situations, reflect, and communicate with others. In a mediated learning situation, something is placed between the environment and the learner. Digital artefacts, such as computers and programs, are physical tools, made by humans for a special purpose, usually produced with certain qualities. These artefacts have truly changed our world, providing access to endless resources created for all sorts of things. Digital artefacts have also changed our way of learning and thinking several times through history (Säljö, 2005).

2.1.2 Structuring resources

The individual along with the sociocultural practice and tools available in the activities create a direct description unit. How we act in specific situations depends on identified purpose of the activity and what applicable resources are utilized (Lave, 1988; Säljö, 2000). The resources structure the activities and establish support for the thoughts and the performances of actions within the activity. Lave (1988) applies the concept of *structuring resources* when researching individuals' approaches to problem solving in similar situations. Structuring resources are essentially everything that people use when they act and solve problems in situations. This includes assumptions, previous knowledge and experiences, expectations and artefacts utilized in interactions with others. This is to say, everything that determines how individuals create knowledge in specific situations, and everything that interacts with what takes place in activities (Lave, 1988). The knowledge or experiences gained in certain contexts are also established as structuring resources in future, similar contexts (Säljö, 2000). Hence, the more familiar one is with the resources in a context, e.g. in a school environment, the more effortless it is to act in it. According to Säljö (2000), structuring resources are a critical part of our learning ability in order to recognize fundamental features of a practice and act in agreement with these. This turns the notion of what a structuring resource is, into an empirical question.

The learning that takes place in school contexts, specifically in the classroom, applies several structuring resources. These can, as previously mentioned, be experiences and artefacts, but also *scaffolding* from a teacher or skillful peers (Hammond & Gibbons, 2005). The concept of scaffolding has its origin in a study by Wood, Bruner and Ross (1976). It is frequently discussed in line with Vygotsky's (1980) concept zone of proximal development, i.e. the difference between what a learner can do on their own, and when they need a teacher's assistance to be able to accomplish something. Scaffolding can be likened to temporary support or guidance from a more knowledgeable individual, challenging the student to move forward in the learning process. In a classroom, there are commonly several ongoing simultaneous activities, where some resources become superior in the shaping of learning

activities (Lave, 1988). Whether artefacts in the shape of technologies, and particularly digital technologies, function as structural resources are interesting aspects of research. Digital technologies imply changes in learning activities and how this digital environment in the shape of structuring resources implies challenges and possibilities in a classroom setting is a main focus of this thesis.

3. Previous research

The previous research chapter starts with the search criteria to select relevant literature for this study. Next follows a brief overview of the policy document that governs the digitalization of the Swedish education. After this, the TPACK framework is introduced. This is followed by a review of research on how technologies have been introduced in education and school settings. Finally, a review of current literature on different aspects of digital tools in education is presented.

In this study, the main field of research is teaching and learning with digital tools and digital software. Since this particular field is not so broad, studies that more generally have explored classroom activities with IT are also included.

The aim of this study is to explore possibilities and challenges in the digital classroom and examine what becomes significant structuring resources in classroom practices mediated by digital tools. To support empirical data and investigate several perspectives, an overview of relevant literature is presented. The literature search for this overview was completed through the data bases SCOPUS, for its focus on technology research, and ERIC, for its focus on education research. The first search was performed on ERIC. Publication dates were limited to 2015-2019 as the field of research changes at a fast pace. Only peer-reviewed research were selected. The keywords used were "educational technology" AND "ICT". This search resulted in a vast amount of research discussing teachers' views or teacher development, which is why NOT "teacher" was added to the search. This resulted in 155 hits, of which the first 30 articles' abstracts were read and when assessed being relevant to this literature review, more carefully read. A second search was performed on SCOPUS, with publication dates limited to 2015-2019. Keywords used in the search were "digital teaching material" AND "education" AND "school", resulting in 32 hits, of which all abstracts were read and assessed based on relevance to this literature review. Later, the search was expanded to include also tablets or iPads, as a lot of research is limited to that digital tool. Thereafter more studies were found through the so-called snowball method (Biernacki & Waldorf, 1981). Policies and other documents have also been employed as they are perceived to be relevant for this thesis. In this literature review, a total of 26 sources are included.

3.1 Sweden's national digitalization strategy

In October 2017, the Swedish government accepted a national digitalization strategy of the education system. The strategy extends to 2022 with the goal that the education system will be leading edge in regard to using the opportunities of the digitalization in best possible ways (Utbildningsdepartementet, 2017). The three focus areas are digital competence through the entire education system, equal access and use of digital resources, and research and monitoring regarding possibilities of the digitalization. The government claims that digital competence is a question of democracy and that all students must understand the impact of the digitalization on the world and on our lives. General access to digital tools among Swedish children and youths differs drastically depending on gender, socioeconomic background and other variables (Statens medieråd, 2015). It is therefore essential that all children and students are provided with equal possibilities of developing digital competence (Utbildningsdepartementet, 2017).

In March 2019, a national action plan for the digitalization of the education system was delivered to the government; #skolDigiplan (Sveriges kommuner och landsting, 2019). This action plan is produced through cooperation between Sweden's municipalities and counties (SKL) and the National Agency for Education, in concurrence with the education system and the business sector. The aim of the action plan is to create conditions for the heads of the education system to reach the goals of the national digitalization strategy (Utbildningsdepartementet, 2017). In order to help the realization of the national digitalization strategy, 18 suggestions of initiatives and activities are presented in the action plan. The initiatives and activities need accommodation through national coordination and development. School leaders and teachers should use these documents and initiatives to relate and implement in their everyday activities in school. In relation to this study, it can be mentioned that a few of the initiatives discuss the importance of equality not only in regard to access to digital tools but also standards in access to digital education material. Education material publishers have a central role in the standardization work as they, together with heads of education, are accountable for production, usage and implementation of the standards. According to the national action plan, digital teaching material and learning resources must be accessible, purposive and functional, in order to facilitate the work situation for concerned staff (Sveriges kommuner och landsting, 2019).

3.2 TPACK

In studies of the use of IT in school contexts, the framework of *Technological, Pedagogical and Content Knowledge* (TPACK) is often put to use (Mishra & Koehler, 2006). TPACK builds on Lee Shulman's (1986, 1987) concept of PCK, pedagogical content knowledge, as necessary prerequisites for teachers' competence in implementing IT in learning activities. This implies that teachers not only need technological knowledge, content knowledge and pedagogical knowledge, but also knowledge of issues raised from the intersections between the different dimensions of technology, pedagogy, and content (see Figure 1).

Figure 1 - The TPACK Image, © 2012 by tpack.org
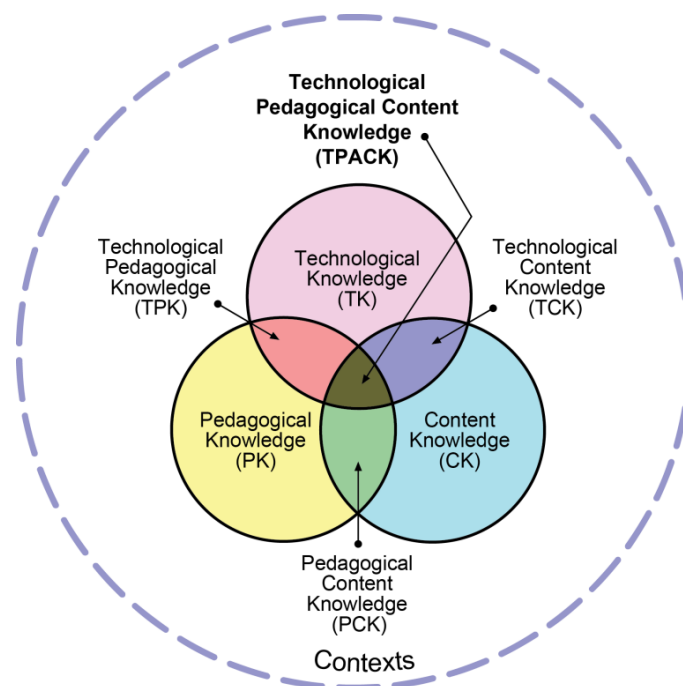
According to Mishra and Koehler (2006), teachers' development of TPACK is crucial to create efficient teaching with technology. The concept of technology applies both to analog and digital technologies, however most technologies in the current literature are digital and quite new (Mishra & Koehler, 2006). By nature, newer digital technologies, being versatile and rapidly changing, introduce new challenges to teachers who are trying to use more technology in their classrooms. Technology, pedagogy, and content are at the heart of good teaching and these three factors are presented to teachers in unique combinations in all situations, individually or together (Koehler & Mishra, 2009). Hence, a good teacher should be able to navigate within and among these elements and their complex interactions in a digital classroom.

3.3 Technology and Learning

During the years, we have seen several research traditions on the subject of technology and education. Currently, there is a vast discussion in the field of research on how to prepare educators for changes and to minimize the present challenges of information technology in education in the future. These challenges are for example low digital competence among teachers (Lindberg et al., 2017) and difficulties in realizing and implementing IT in the school context (Sjödén, 2014). In a review of the literature on the history of educational IT, Sanders and George (2017) point at three commonly occurring arguments advocating IT use in education. First, a common belief is that schools are responsible for preparing students for their future as employees, which demand advanced technological skills. However, as IT has such rapid evolution, the skills taught at school are usually outdated by the time students leave school (Sanders & George, 2017). This, and the insight that many jobs require context-specific knowledge that is better developed in the workplace are two factors diminishing this argument. Second, schools are thought to equip students with authentic education preparing them for social independence, such as skills to access information and develop a mindset of critical information consumers (Peña-López, 2015). This hopefully results in equal access, avoiding a digital divide between students with and without access to technology outside of school. The third, and probably most powerful argument include the pedagogical aspect and educational benefits of IT (Falloon, 2015; Wellington, 2005). Researchers discuss claims of increased information access, and more engaged and motivated students in their learning processes. A commonly asked question is, however, if IT in education actually adds educational value and is worth the investments in time, teacher education, and money. While there is some documentation on increased efficiency in both the teaching and learning process, there is little evidence on the way of improved efficacy (Sanders & George, 2017). There is a common concern for IT being applauded as the solution to all educational problems, as previous technologies that have not succeeded to meet the expectations. Hence, one should not assume that IT itself will solve all school related problems and difficulties, but that it takes time and effort to implement good routines and strategies.

Sanders and George (2017) also represent the stages of the innovation cycle when new technologies are introduced in education. Top-down decisions lead to the installation of new, costly systems that often are followed by inadequate teacher training. In many cases, these systems are therefor received with negative attitudes and low uptake by educators. However, a small number of enthusiasts often adopt and exercise the systems. The low uptake can also be a result of ineffective pedagogical usage and poor software design, causing a failure of the technology to enhance learning. Due to several reasons, e.g. lack of finances, systems that are not constantly developed or improved become outdated and futile. The fading out of the

technology is followed by new innovations and visionary stakeholder, repeating the cycle again and again. This argument is shared by Säljö (2010), who indicates that technology can merely change how learning happens, contrary to changing learning or performance success. A 'one-fix-for-all'-approach is an unrealistic expectation of educational IT. A slightly different view is represented by Kirschner, Martens and Strijbos (2004), who maintain that technology is considered a powerful, mediating tool that itself will improve teaching and learning, and that helps to facilitate extensive cycles of learning. They argue that the interesting matter is what meanings students attach to technology, and how it is used in everyday school practice.

3.4 Digital tools in education

In the following, several different aspects of information technology and digital tools related to education that are brought up in the literature will be accounted for.

3.4.1 IT for learning or administration

The main focus on IT in education is often to administrate, distribute and implement digital tools, rather than them being used to teach in a differentiated better way. The possibilities of utilizing IT are then lost on the way and content and quality often end up being left overlooked (Haelermans, 2017; Sjödén, 2014). This is for exampled shown in Sjödén's (2014) study which aims at drawing up some guidelines for qualitative revisions of digital teaching material based on science, as well as facilitating teachers' adoption of digital tools as pedagogical teaching tools. Sjödén (2014) maintains that it is important that pedagogically relevant content and digital values are the focal point rather than administrative and technical aspects.

3.4.2 Digital resources compared to analogue resources

One may think that digital teaching material resembles printed material in several ways, but a number of studies reject this idea (Grönlund & Wiklund, 2018; Jahnke & Kumar, 2013). One study that derives from this presumption is Jahnke's and Kumar's (2013), in which the aim is to explore how and for what purposes teachers use iPads in their classrooms and to display the potential of tablets for teaching and learning. Data from 13 classrooms observations and 10 interviews in five Danish schools using iPads were collected and analyzed according to the theoretical framework "iPad-didactics". The observations ranged from preschool up to ninth grade, several different subjects, and class sizes of 14 to 25 students. The paper presents an initial analysis from two of the classrooms serving as insights on iPad use in the classroom. The authors initially raised the question in their study whether or not iPads would serve as a textbook substitute. However, data shows that this was not the case, but that teachers instead design new approaches in their teaching to create complex learning activities for the students. In the study by Grönlund and Wiklund (2018) the result is not as straightforward. Their study is a result of the three-year-long project "Det digitala lärandets möjligheter – Att leda den digitala skolan" (The possibilities of digital learning – To lead the digital school). Through interviews and questionnaires with students and teachers from 13 upper secondary school classes at five different schools, the authors aim at contributing to the debate on how digitalization should be realized in schools and to examine the effects on learning when digital tools are implemented. In their research, similar to this master thesis, a sociocultural perspective of learning is used as the theoretical base. Grönlund and Wiklund (2018) express that digital teaching materials usually contain new functions that provide opportunities for teachers and students. These are digital functions such as animations, movies, quizzes and

more, aiming at making the material more accessible, functional and conceivable than printed teaching materials. The matter of utilizing these functions does however not appear to be as straightforward. Students sometimes listen to the texts in their digital materials; however, they rarely work with techniques such as highlighting, emphasizing or commenting digital texts (Grönlund & Wiklund, 2018). According to questionnaires, such functions are unknown to many students. While Grönlund and Wiklund (2018) maintain that even if digital teaching material have different possibilities than printed material it is not set that these will be utilized. Both Jahnke and Kumar (2013) and Sjödén (2014) maintain that digital teaching material should not be viewed as or compared to analogue material. Rather, the evaluation of digital teaching material should commence with the computer as an integrated part of the learning process, with focus on how digital technology can strengthen and unburden human cognitive resources (Sjödén, 2014).

3.4.3 Quality of digital teaching material

Quality aspects are another issue discussed related to digital teaching material. Liu, Jin, Liao and Zhao (2018) consider the extensive use of digital teaching material and pose the question whether or not higher quality materials have more rewarding learning outcomes than lower quality materials. An experiment was carried out to see if the investments on digital teaching materials actually provide significant difference in learning outcomes. Art students from a secondary vocational school and students at a university in Shanghai were randomly divided into groups to take part of a learning process with either high-quality or low-quality digital teaching material. Data was collected and analyzed by focusing on affective, cognitive and behavioral aspects. The results show that high-quality digital teaching material receive higher ranks than low-quality in almost all cases, however the differences are not as notable as the researchers expected (Liu et al., 2018). The high-quality digital teaching materials appear more effective for the secondary school students than for the university students. An explanation might be that younger students do not have the same capacity of comprehension and abstract thinking, hence have a higher need of and gain more advantages from visual representation as an aid. The results, however, are still not impressive, regardless of the two groups. The researchers claim that before investing on a, perhaps expensive and timely high-quality digital teaching material, a second thought is suggested to verify that it is a fair investment. Liu et al. (2018) also point out that teachers are extremely important in order to realize the potential of digital software and hardware, which will be elaborated in paragraph 3.4.11.

3.4.4 Information gathering

Specific aspects regarding the idea that IT has the possibility to unburdened human cognitive resources which can be used for deeper analyses is time and energy released from quick access to information. Several studies pinpoint that digital devices are good tools for information gathering (e.g. Guðmundsdóttir et al., 2014; Lindberg, Olofsson & Fransson, 2017; Mavri, Ioannou, Loizides & Souleles, 2018; Öman & Svensson, 2015). For example, in the study of Guðmundsdóttir et al. (2014) aiming at examining pedagogical use of tablets and interactive whiteboards, findings show that the opportunity of impulsive Internet quests have an impact on the didactical design and appear to be time saving. With access to the Internet and all various sources of information it brings, students get more relevant and practical learning experience, similar to real life learning. Also, in the previously mentioned study by Jahnke and Kumar (2013), one of the teacher's strongest opinion of why iPads are good tools in teaching and learning is that it gives everyone access to information, leading to all students having the same resources. Moreover, in the study by Lindberg et al. (2017), examining

students' and teachers' views and use of educational IT, teachers find students' continuous access to online material to be a positive aspect of IT in the classroom. Students in the study by Öman and Svensson (2015) searched for answers online, driving the group work forward. Learning opportunities are enhanced by e.g. navigating the Internet and collaboratively reflecting upon and discussing information. Good digital teaching material utilizes the digital technique's potential of producing and organizing knowledge in new ways that support various learning processes (Sjödén, 2014). However, in some studies, students occasionally prefer traditional teaching material. This is, for instance, one of the findings in the study by Kontkanen et al. (2016), looking at students' experiences in regard to iPad usage. In the study 84 students in a Finnish upper secondary school who had used iPads for three years were asked to write two letters, one to a student and one to a teacher, about how to use an iPad in learning respectively teaching. Additionally, four group discussions were recorded on the same topic. The data was analyzed thematically according to the TPACK framework. A concrete way of using iPads is often dealing with information, e.g. information retrieval. Students discussed the option of using traditional tools, like books, paper and pencil in some cases. They pointed out that they prefer some physical material, and that it is sometimes nice to perform tasks that do not include the iPad (Kontkanen et al., 2016). This is a sensitive matter, as some students want more iPad use while others want less. Thus, for teachers, digital teaching material can provide support for teaching, for example by clarifying material, processes and learning structures. The digital technologies then have the possibility to do more than simply producing and presenting knowledge in various ways, by affecting the whole teaching-learning process, but whether this actually happens cannot be taken for granted.

3.4.5 IT as student distraction

IT in the classroom is frequently debated in media as disturbing and is also reflected on in several studies, where problematic views of digital tools as distractions are mentioned. This can be found in the previously mentioned studies by Hylén (2013), Kontkanen et al. (2016) and Lindberg et al. (2017). In the article by Kontkanen et al. (2016) students mentioned excessive Internet use, and iPads being used a lot for entertainment. However, iPads offer relaxation between studying through playing games or using the Internet. This was seen as a motivation by some students, while others viewed the escapism from lessons as bad and distracting. Some students found it possible to play games and adhere to instructions simultaneously (Kontkanen et al., 2016). On the one hand students want independence in deciding how to work with iPads, while they on the other hand question their own competencies regarding managing the independence. Teachers are expected to control iPad usage in class, however not too strict. Students being distracted by having access to the Internet was seen as an issue by teachers also in the study by Lindberg et al. (2017). A drawback with iPads found in the aforementioned article by Hylén (2013), is that of the iPad being viewed as a tool for entertainment rather than for education. However, it is also pointed out that if students want to 'escape' from the lessons, iPads are not the only way (Kontkanen et al., 2016).

3.4.6 Interactivity in interactive technologies

By the term, one may think that interactive technologies are presumably interactive. Research shows that this is not automatically the case. Guðmundsdóttir et al. (2014) aim at examining pedagogical use of tablets and interactive whiteboards. The study includes two case studies from two different schools in Norway that were in the initial phase of implementing interactive whiteboards respectively tablets. Observations and interviews were conducted with

three teachers and two groups of students at school A. Three lessons were observed, and teachers, school leaders and two groups of students were interviewed at school B. The latter of the schools was the one implementing tablets, while the former was implementing interactive whiteboards. In the study by Guðmundsdóttir et al. (2014), authors conclude their research findings by emphasizing that interactive technologies only are interactive when employed as a tool for cooperation and reflection, in the interaction between people, or in the interaction between a person and technology. The way technology is used establishes what kind of interactivity that is developed. It also establishes if we even can discuss interactivity, or simply interactive technologies used in learning settings. Interactivity reaches beyond technology, capturing relationships between teachers, students and communication. Sjödén (2014), mentioned previously in this study, emphasizes that interactivity plays a crucial part in digital teaching material. Here, the author refers to interactivity between a user and the material, such as a user's actions and options to affect representation, for example how to maneuver in the virtual environment and get feedback from the system. Interactive technologies alone do not seem to automatically improve teaching and learning (Guðmundsdóttir et al., 2014), and although interactive technologies have the potential of enhancing work processes, the potential is not always realized.

3.4.7 Digital tools for enhanced learning

In research as well as in school, there is a vast discussion about what digital tools are most suitable for classroom use. Interactive whiteboards were developed for collaborative use and work well for class discussions and whole class teaching, while tablets were originally developed for more individual use and works better for small group collaboration and individual teaching activities (Guðmundsdóttir et at., 2014). Hylén (2013) concurs with this idea and the fact that tablets were not originally developed for educational purposes. According to Guðmundsdóttir et al. (2014), tablets were introduced in educational settings before there was any research on the subject. Hence, there were not any evidence that tablets would actually enhance learning. The same tendency is seen also with other interactive technologies. However, tablets can easily be shared on a large screen and provide unique collaboration possibilities. Additionally, some of the participating teachers in the study by Guðmundsdóttir et al. (2014) were all excited to implement tablets into their pedagogy and surprised to well how well it suited the learning purpose. Interactive applications, touch-screen, portability, size and user-friendly interface are characteristics of iPads making them suitable for classroom use. Guðmundsdóttir et al. (2014) show that tablets bring new possibilities for spontaneous and useful activities, as they can be used whenever needed. A study by Mavri et al. (2018) examines the contribution of iPads in higher education, with a special focus on boosting active learning. Eleven second-year students were provided with one iPad each to work collaboratively on assignments. The remaining eleven students in the class instead worked collaboratively on their laptops or desktops. Empirical data was collected through surveys and focus group sessions. The findings of the study by Mavri, et al. (2018) indicate that iPads possess capacity for experimental and spontaneous tasks, in accordance with Guðmundsdóttir et al. (2014).

3.4.8 Collaboration, interactivity and communication as a result from educational IT

Whether or not IT in the classroom actually increases collaboration and interactivity seems to be a matter where researchers' opinions differ. Several studies present results that show how tablets, educational IT and digital teaching material foster collaboration (Guðmundsdóttir et al., 2014; Jahnke & Kumar, 2013; Lindberg et al., 2017) and interactivity (Guðmundsdóttir et al., 2014; Sjödén, 2014; Uygarer & Uzunboylu, 2017; Wang, Teng & Chen, 2015; Öman &

Svensson, 2015). This can for example be seen in the study by Öman and Svensson (2015) where ways in which educational IT support primary school students' dialogic and synergistic interaction within group activities were explored. Video recordings were collected and later analyzed according to the interactivity analysis framework and findings imply that interaction patterns varied between the six recorded groups. In some groups the digital tools played a passive role during collaboration, while a majority of the groups acknowledged the resource as an interaction partner which opened up for learning opportunities. Findings from the earlier mentioner study by Wang et al. (2015) show that there are more interactions between students and teachers in a classroom where iPads are introduced. Another example of how collaboration is promoted by the use of IT is found in the previously referred study by Guðmundsdóttir et al. (2014). In this study tablet use is shown to support student collaboration, as students felt it was easier to work together. The tablets facilitate a different approach to collaboration, demonstrating pedagogical interactivity. When students were given an assignment, they aimed their spotlight at it and were occupied by solving the task, either alone or in a group. The authors emphasize that the classes had homogenous students with good working atmosphere. However, the tablets certainly did engage them. Students were more active in their learning process, collaborating while having the teacher in the background for support when needed. In all three schools in the earlier mentioned study by Lindberg et al. (2017) the LMS worked well for handing in assignments, collaborating on documents and communication among peers and teachers. Students believed that digital devices in general were good tools for writing, communicating, information gathering, collaboration, and using software for educational purposes. Several studies agree on communication as a positive factor of digital tools (e.g. Guðmundsdóttir et al., 2014; Hylén, 2013).

Contradictory to the above-mentioned studies where data show that digitalization increases cooperation and interactivity in the classroom (e.g. Guðmundsdóttir et al., 2014; Jahnke & Kumar, 2013; Wang et al., 2015), the previously referred research by Grönlund and Wiklund (2018), shows increased amounts of individual work as a result of educational IT. Students and teachers voice that the amount of time students work individually has increased along with the digitalization (Grönlund & Wiklund, 2018). Individual work in the classroom can cause students to become worried that they will not get the support they need, starting to disrupt and disturb their classmates. Students experience responsibilities in their own learning, and that they themselves are responsible to use their digital tools in a correct way in the classroom.

3.4.9 Possibilities for individualization
Whether or not IT will improve students' learning and enable individualization and motivation is another frequently discussed aspect. Haelermans (2017) aim at contributing to this debate regarding effective IT use in education by combining previous research with eight experimental studies in secondary education in the Netherlands. The studies took place in middle school, grade seven through nine, covering the topics mathematics, biology, and language and spanning between six weeks up to four months. From her literature review, Haelermans (2017) concludes that in studies where IT is used integrally by the teacher, computer-assisted instruction (CAI)[2] shows small but positive effects compared to traditional classroom instruction. Conclusions from the eight experiments in Dutch secondary education present significantly positive effects for mathematics and some aspects of language learning.

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[2] CAI: programs using technology as instructional material to support students' learning

Findings on mathematics concur with what is found in literature, however, findings on language learning differ, since no effects in developed countries are found in literature. According to Haelermans (2017) both experiments and literature show that IT provides effective possibilities for individualization and individual learning paths. This idea is consistent with e.g. Guðmundsdóttir et al. (2014), who mention that tablets work well for individual work and individual teaching-learning activities, and previously mentioned Sjödén (2014), claiming that digital teaching materials have opportunities to be individually adapted.

Once digital material is individualized, it can also be shown that individualized exercises and material depending on the level and interest increases student motivation (Haelermans, 2017). Additionally, motivation is mentioned as a positive factor both by students in teachers in a study by Hylén (2013). iPad use was evaluated in 13 schools ranging from preschool to upper secondary school. Research questions included aspects of successful learning situations and increased student motivation with iPads, as well as whether or not iPads can replace laptops for classroom education. Empirical data were collected through a teacher questionnaire, classroom observations, group interviews with teachers and students and self-reported answers from participating schools. A vast majority of the teachers think that students are more easily motivated and that it is easier to use different education methods (Hylén, 2013). Also, the study by Wang et al. (2015) shows that using iPads in language education increases students' motivation for learning. One reason for this was the visual effects provided by IT. While Haelermans (2017) only find some aspects of enhanced language learning, Wang et al. (2015) and Hylén (2013) present differentiating outcomes. The aim in the study by Wang et al. (2015) is to examine if students' English language acquisition was improved by using iPads. Two freshmen classes in a private university were divided into two groups; one experimental and one control group. The experimental group was asked to fill out a survey for researchers to better understand students' attitudes. Results show that students who were instructed to use an iPad performed better on the post-experiment test. The survey demonstrates that students agreed on iPads as a classroom tool that can enhance language learning. It is notable that this research was performed at university level and with a rather small sample.

3.4.10 Students' digital competence
The use of the resource and teacher instruction seem to be two main critical factors for educational IT use. Öman and Svensson (2015), mentioned earlier, discuss in their study that students' skills in regard to handling the technology are not crucial in achieving dialogic or synergistic interaction. According to the previously mentioned Kontkanen et al. (2016) students found iPads to be a versatile, handy, and easy-to-use devices suitable for their intentions. Technical features were not criticized. In contrast, questionnaires in the study by Grönlund and Wiklund (2018), as previously mentioned, show that 25% of the students did not believe that they had strong enough digital competence to manage all the assignments given to them by the teachers. Teachers and students in the study described how students support each other in usage of digital tools and digital competence. Usually, each class or at least each school has one or more students with higher digital competence than the others.

3.4.11 The role of the teacher in a digitalized classroom
A current public debate is the expectations of technology to change and improve school performance, as discussed in e.g. the previously mentioned article by Kontkanen et al. (2016). If technologies are introduced into schools without relevant pedagogical approaches that take advantage of the possibilities, there is a risk of interference in teaching and learning. Tailored

pedagogical practices are needed to avoid repetition of old patterns and hindering of concentration and learning. Several students in the study by Kontkanen et al. (2016) mentioned that many of the pedagogical actions using iPads in the classroom were similar to school work performed without iPads and technology, e.g. writing essays or as a word book. New technology is not what alone can change pedagogy if teachers simply transfer old methods to the new tools. Without supportive pedagogical approaches and extensive knowledge about features, tablets, or any other interactive technologies for that part, will not lead to a transformation of the pedagogical practices currently existing in the classroom. Guðmundsdóttir et al. (2014) express concerns regarding what pedagogical approaches and strategic choices teachers make when establishing interactive technologies in their classrooms. The more interactive elements teachers introduce into presentations and lectures, the more time for designing or programming is necessary. As it does require extra effort and equipment, teachers initially avoid implementing more than needed. In a study by Lindberg et al. (2017) the views and use of IT in Swedish upper secondary schools are examined in terms of students' and teachers' perspective of IT in education and what is perceived as challenges and possibilities. Furthermore, it was examined if students' and teachers' opinions were in agreement. From three different schools, 25 teachers were individually interviewed, and 39 students were interviewed in small focus groups. The findings show that IT is considered to be useful for teaching, but that the level of usage highly depends on the subject. Teachers experienced that challenges with IT in education were mostly related to matters of subject, curriculum and time. Their experience is that it usually takes a lot of time to design and prepare IT-supported lessons, including finding relevant digital material. Overall, the potential of IT in education is dependent on how it is used and what purposes it is expected to serve (Haelermans, 2017). Öman and Svensson (2015) conclude in their previously mentioned study that students' ways of adopting technology as a learning opportunity is often connected to teachers' instruction and competence.

Teachers' digital competence is clearly a relevant matter that has been mentioned in several of the referred studies in this literature review. Lindberg et al. (2017) confirm that a main challenge of IT in education, perceived both by students and teachers, is teachers' generally poor digital competence. Teachers need to obtain knowledge on how and why various software and hardware work. When discussing students' work on the interactive whiteboards, teachers experienced losing control over the learning process, and that a greater focus was put on the technology rather than on educational benefits (Guðmundsdóttir et al., 2014). Both Guðmundsdóttir et al. (2014) and Lindberg et al. (2017) acknowledge that teachers experience IT implementation as time spending, and therefor might avoid implementing more than necessary.

To sum up, drawing from the previous research in the field of educational IT, it is obvious that studies contradict each other in several aspects, and that implementation and pedagogy seem to be two main focus areas on IT in the classroom. The areas that have been reported on in this section discuss how IT can be introduced to enhance learning rather than focus on administration, how digital and analogue teaching differs, and the quality of digital teaching material. The chapter also discusses IT and digital tools as sources of information, potential distractions, and facilitators for enhanced learning, collaboration and individualization. Finally, teacher roles in educational IT classrooms are shown to be significant for students' opportunities to take advantage of the possibilities of digital recourses in learning activities. Teachers' requirements for specific professional digital competence implies that there is need

for continuous in-service programs and professional development efforts that focus on digital aspects of teaching and learning.

4. Method and data collection

This chapter presents the setting of the study, the digital teaching material that was used at the school where data was collected, choice of method, analysis of the data collection, collection of the empirical material, and ethical considerations. The empirical material consists of data from semi-structured interviews and unstructured observations collected at a secondary school in Sweden. This study, as well as of the data collection, aims to explore possibilities and challenges in the digital classroom and examine what becomes significant structuring resources in classroom practices mediated by digital tools.

A case study method has been used in this research. Case studies usually require multiple tools for data collection and sources of evidence; they often employ mixed methods (Cohen et al., 1993). This study could be described as a kind of ethnographically inspired research with observations of classroom where fieldnotes of the activities were conducted, followed by recorded interviews. However, the main data for this study were the interviews, while the classroom observation mostly functioned as general background knowledge and to inform the interview questions. To make the research process explicit, table 1 below presents an overview of the timeline with the preparation phase including several meetings in the school and the main study involving the generating and processing of data.

Table 1 – Overview of the research process and collection of empirical material

Date	Context	Action	Time	Transcription of field notes
Dec. 2018	School	Introductory meeting with the school's assistant principal		
Jan. 2019	Gleerups	Pilot day for Gleerups' pilot schools		
Feb. 2019	School	Presentation of the project to teachers at the school		
Feb. 2019	Class 7A, 7B, 9A	Meeting with teachers and students to present the project and hand out and collect consent forms		
March 2019	Class 7B	Collection of signed consent forms	65 min.	½ page
March 2019	Class 7A	Collection of signed consent forms	65 min.	½ page
March 2019	Class 9A	Observations – online quiz, video clip	60 min.	1 page
March 2019	Class 7A	Observations – introduction of new topic, source credibility, online quiz	50 min.	½ page
March 2019	Class 7B	Observations – introduction of new topic, source credibility, online quiz	60 min.	1/3 page
March 2019	Class 9A	Observations – quiz, Google classroom, video clip	60 min.	½ page
March 2019	Class 7B	Observations – online presentation, online quiz, individual reading, assignments in Gleerups	60 min.	1/3 page
March 2019	Class 9A	Observations – Google classroom, work on tablets	60 min.	½ page
March 2019	Class 7A	Observations – assignments in Gleerups, group work	80 min.	1/3 page
March 2019	Interview teacher 1	Individual interview – grade nine teacher	62 min.	6 pages
March 2019	Interview 1, 9A	Focus group interview – five students from 9A	34 min.	2 ½ pages
March 2019	Interview 1, 7A	Focus group interview – six students from 7A	33 min.	2 pages
March 2019	Gleerups	User day for all schools using Gleerups' digital teaching material		
April 2019	Interview 2, 9A	Focus group interview – three students from 9A	17 min.	1 ½ pages
April 2019	Interview teacher 2	Individual interview – grade seven teacher	34 min.	2 pages
April 2019	Interview 1 & 2, 7B	Focus group interview – five + five students from 7B	17 + 13 min.	1 ½ + 1 pages
Jan-April 2019	School	Informal discussions and e-mail conversations with the assistant principle		

4.1 The setting of the study

The empirical research has been carried out at a secondary school in a larger city in Sweden. The school ranges from grade seven through nine, with students of the ages twelve to fifteen. 400 students are divided in six or seven classes per grade. The school is placed in an area with inhabitants of varied cultural and social background, hence also the students' backgrounds vary. Some of the students in the school are newly arrived to Sweden. The school, its students and its teachers have considerable awareness of digital tools, programs and resources and the assistant principal values IT-security greatly (Personal communication, March 31, 2019). Each student is equipped with a personal tablet used to gain new perspectives in learning and enhanced digital competence (School website, blinded for ethical reasons). The school works concentratedly on providing a venue where students can raise their voices. In addition to class councils, student councils and a pupil board, the school has an IT council. In May 2019, the IT council consists of five students who are given the possibility to present their and their classmates' opinions to influence the use of digital tools at the school.

According to the school's assistant principle, the school chose to provide their student with tablets as it is a creative, easy-to-bring tool. Previous experiences from other schools where students and teachers were equipped with MacBooks showed, according to the assistant principal (Personal communication, March 31, 2019) that teachers and students used their computers merely as a tool for writing, not realizing the potential of a digital tool. Students also found the computers to be too heavy, hence leaving them at home leading to even less realization of potential usage. The tablet was considered to solve both of these problems, as it is a more interactive tool and lighter and easier to bring. The tablets are not equipped with a keyboard as it is not procured by the municipality. A group of teachers and students from the IT council are during the spring semester of 2019 trying out Chromebooks in their school work. The school board's notion is to keep tablets for grade seven and eight, and to possibly switch to Chromebooks in ninth grade. In this way, students keep the creative opportunities of the tablets, while learning different operative systems and typewriting. Students in general write longer texts in the ninth grade, and many high schools in the municipality provide their students with computers rather than with tablets.

The school implemented Gleerups' digital teaching material in a majority of the subjects. Digital tools were generally used more by the older students, as they were given more freedom and independence in their usage. In the ninth grade, Gleerups' teaching material were used in all subjects but modern languages and mathematics. As previously mentioned, all students were equipped with their personal tablet which they used to work with Gleerups' digital teaching material and other material. The school became a pilot school for Gleerups' digital teaching material in 2017 to create greater similarity from one central teaching material. It was through Gleerups that contact with the school where the empirical data has been collected was established. The concept of pilot schools will be more thoroughly discussed in a paragraph further on. The school leaders wanted teaching and learning to look more similar throughout all subjects while increasing usage and knowledge of working digitally and utilizing the advantages of working digitally. The possibility of individualization for all students and functions such as comments and adaption of the text played a big part in the decision. The assistant principal (Personal communication, March 31, 2019) pointed out that Gleerups should act as the base teaching material across the school, but that digitally competent teachers employ also other material to enhance their teaching.

The two teachers who have participated in this research teach seventh grade social science respectively ninth grade English and seventh through ninth grade Spanish. The social science teacher became a qualified teacher in June 2018 and has taught at the same school since August 2018. The language teacher has worked as an educator for around ten years and is currently completing teacher education and will in June 2019 graduate as a qualified teacher. Both the teachers have very recent experiences of the Swedish teacher education program and the courses covering IT for education. These two teachers took part in the study as they showed interest in their classrooms being observed and to participate in interviews.

4.1.1 The digital teaching material used in the study

As mentioned before, many teachers at the school use digital teaching material provided by the education publishing company Gleerups. Since 1990, Gleerups has published an assortment of analogue and digital teaching material for Swedish education (Gleerups, 2019b). Gleerups' digital teaching material are available in Swedish, mathematics and English for grade one through three (Gleerups, 2019a). 15 different subjects are available for grade four through sixth and grade seventh through ninth grade. For upper secondary school, Gleerups' digital teaching material are available in a wide variation of courses, for example special pedagogy, entrepreneurship and network technology.

Gleerups' digital teaching material is developed in close cooperation with students, teachers and school leaders around Sweden (Gleerups, 2019a). The process of testing and evaluating digital teaching material is done with the assistance of pilot schools and pilot classes. The pilot schools and Gleerups are in close contact and share experiences. Spring semester 2019, Gleerups has around 20 pilot schools connected to them, from elementary school through upper secondary school. The school where the empirical data in this study has been collected is one of the pilot schools. A pilot school's teachers are urged to actively use Gleerups' digital teaching material as a fundamental part of their education. Technical eligibility, proficient network and digital tools for all students is demanded for a school to be able to participate. Three to four times during the school year the pilot teachers meet with Gleerups for common training, discussion and feedback.

All 15 of the subject specific digital teaching materials for secondary school, several of which are employed at the observed school, are comprehensive and up-to-date, composed from the Swedish curriculum Lgr 11 compiled in 2011 and revised in 2019 (Skolverket, 2019). All material is interactive and multi modal, containing text, sound, pictures, movies and animations (Gleerups, 2019a). The material is flexible in the sense that it is easy to create individualized learning experiences, through highlighting, adjusting colors, adding own material, and other accommodating options. For students with special needs there are several aids to tailor the material even more. Gleerups' material supports education for newly arrived students. The material has embedded functions such as translation, speech synthesis, pictures and summarizing movies. Gleerups' idea is that the material should adapt to the students, not vice versa. Gleerups' teaching material is available on all types of digital devices, making it accessible and mobile. Internet connection is necessary to work with the material, which is saved digitally and therefor can be resumed anywhere and on any device. The material contains exercises and practice quizzes that are easy to follow up and overview for teachers. Teacher users can themselves add on to the material with own links and other useful material, making it more adaptable for all students and for specific teacher's way of working. These

add-ons are shared with others contributing to collegial learning. Additional to Gleerups, the teachers in this study use the municipality's web-based IT-support, G Suite for Education[3], Mentimeter[4], Kahoot[5] and Quizlet[6] in their teaching.

4.2 Choice of method

The methods for collecting the empirical data have been classroom observations and interviews; focus group interviews with the students and individual interviews with the teachers. The aim of the empirical research was to, by unstructured observations and semi-structured interviews, explore the teachers' and the students' perceived possibilities and challenges in the digital classrooms.

Interviews were chosen to gain detailed and comprehensive responses and encourage conversations with and amongst the interviewees. Rather than using questionnaires, interviews give the opportunity of relating to the respondents; listening to nuances in their utterances, interpreting body language, and encouraging development of thoughts. Questionnaires do not offer these benefits. Interviews are a flexible tool for data collection (Cohen, Mannion & Morrison, 1993). An interview may be controlled by the interviewer, while it at the same time gives opportunities for spontaneity and discussions. Obviously, questionnaires have the advantage of enabling a larger number of responders, but people will often have a greater urge to help and give opinions by the physical presence of an interviewer (Thomas, 2017). For me as an interviewer, the goal was to be seen as a peer, especially by the students. I did not want them to look at me as an authority or teacher, but rather a friend with whom they had a conversation. The focus of the interviews was not to ask questions which had correct answers and would give straightforward answers, but to encourage reflections. This is why I, as Thomas (2017) stated, tried to "read" the respondents and paid attention to their behavioral and linguistic giveaways and took notes of this during the interviews.

Semi-structured interviews are a good strategy, combining a structure with issues to be covered with the freedom to ask follow-up questions as necessary, according to Thomas (2017). In focus group interviews, the group setting can affect respondents in a positive way, making them more talkative, adhering to each other and leading the discussions forward (Cohen et al., 1993). Of course, group settings can also make people shy and silence or impeded to state opposing opinions. The approach in focus group interviews is that the researcher takes on the role of a facilitator (Thomas, 2017). The aim is to facilitate discussion among the participants, and not for the facilitator to engage in the discussions. Thomas (2017) claims that establishing a relationship, putting the interviewee at ease before the interview begins, is advantageous. As several observation occasions took place in all classes before the interviews, relationships were initiated with most of the students. It appeared to be more effortless to establish relationships with the younger students, as they were more open and interested in the work than the older students. Some interview groups did not turn out to be well composed, as students were shy and silent, while other interview group were more agitated, joking and starting to discuss unrelated matters. Overall, student interviews provided desired outcomes, although more consideration could have been given of group dynamics

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[3] https://edu.google.com/intl/sv_ALL/products/gsuite-for-education, Google's integrated solution for education.
[4] https://www.mentimeter.com, an interactive presentation software.
[5] https://kahoot.com, a game-based platform aimed at making learning more inclusive, fun and engaging.
[6] https://quizlet.com, a learning tool that lets you create flashcards and games.

when composing the groups. How the focus group interviews were carried out in this study is described below in the section titled "The study".

According to Thomas, "observation is one of the most important ways of collecting data in social research" (2017, p. 226). Observations provide researchers with the possibility to gather 'live' data from naturally spontaneously occurring social situations (Cohen et al., 1993). Unstructured observations are undertaken when the observer immerses themselves in a social situation in order to comprehend what is going on in that situation (Thomas, 2017). Sometimes unstructured observation is also called participant observation. This implies that observers become participants in the situation they are observing, with the intention to observe participant behavior in everyday social settings (Cohen et al., 1993). According to Simpson and Tuson (2003), unstructured observation or participant observation requires the researcher to become a member of the group to gain access to behaviors and activities, while maintaining some degree of detachment as a researcher. Observations provide the possibility to walk around in the classroom, inspect from closer distance and gain a good background understanding of the students learning activities. This is also how the observations developed. It was difficult to observe the classroom from the back of the room, to get a good overview and see the students' screens, as students chose their own seats. However, walking around in the classroom and standing in the back gave a comprehensive perspective of classroom activities. It was also difficult to see what all students were doing on their tablets even when being positioned in the back, which is why circulating in the classroom was a good option. Some informal conversations were conducted as a part of the observation, e.g. asking students about specific choices they made in their tablet usage. Some students were very aware that they were being observed, while others viewed me as a teacher figure whom they asked questions or a friend to have a chat with.

4.2.1 Limitations of research methods

Other research methods, such as video recording would have given another kind of rich data. However, video recordings also involve other kinds of ethical considerations, and it would perhaps be more difficult to get approval from students to participate. In the classroom environment, several video cameras would have been needed to be able to record all students, the teacher as well as the screen. This method would also be more time-consuming. Based on these considerations and the above discussed possibilities of interviews and participant observation these methods were chosen for this study. How the observations were carried out in this study is described below in the section titled "The study".

4.3 Analysis

Thematic analysis is the main framework used to analyze the findings of this study (Braun & Clarke, 2006; Clarke & Braun, 2017). A thematic analysis is a common qualitative analytical approach, as it is a method for identifying, analyzing and interpreting themes within qualitative data. The analysis is, according to the procedure described by Braun and Clarke (2006), a six-phase process of familiarizing yourself with your data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. Accordingly, this study has followed the six steps. Once the empirical data was collected and transcribed, transcripts were read several times with the aim of getting familiarized with the data. Initial codes and themes were generated in order to organize the data in a meaningful way. The codes where then examined and collated into initial themes. Themes were reviewed, modified and developed several times, resulting in seven themes.

During several iterations of the thematic analysis, initial codes went from specific, ending up in overbridging themes intended to answer the research questions of this thesis. For example, themes under the heading possibilities were previously divided into several smaller themes. Individualization, creativity, information retrieval and collaboration were all individual themes, to eventually be assembled in the overall theme organizing learning. Finally, in step six, the findings were produced. The analysis was conducted manually.

4.4 Data collection

A standpoint going in to this research was to be greatly flexible when collecting the empirical data. As previously mentioned, this school was selected based on its pilot school cooperation with Gleerups. Even though some preferences based on sample groups were generated, an open mind was held not to exclude any options, such as grades or subjects. The assistant principal raised the opinion that it would be best to carry out the research in ninth grade classes, since those students have full access to their devices and use them as well as Gleerups' digital teaching material in several subjects. One ninth grade English teacher expressed a will to participate, but no other ninth grade teachers expresses interest to participate in the study. The assistant principle indicated that Gleerups' digital teaching material was used extensively in social science, which is why this subject would be a good base line for the empirical research. The assistant principal put me in contact with a seventh-grade social science teacher, who had expressed interest to participate in the study. This is why these subjects and grades ended up as the base for the observed and interviewed classes. Focus group interviews were held with students during lessons in order to create an open atmosphere and make students more comfortable in the interview setting. Individual interviews were held with the teachers, as there were only two of them and as the interviews were carried out right before or after their classes. Before the interviews, an interview framework with desired issues to discuss was prepared. The framework mainly consisted of bullet points with different topics, and a few straightforward questions. The framework for the student interviews and teacher interviews contained slightly different questions. Both frameworks focused on perceived possibilities and challenges of digital tools in the classroom. Neither the teachers nor the students had access to the frameworks beforehand. The interview frameworks can be found in Appendix A.

Five focus group interviews were conducted with three to six students in each group. These interviews lasted between 13 and 34 minutes. All the interviews were recorded, transcribed and later analyzed. The initial transcriptions were coarse in order to be time efficient. Selected excerpts have been precisely transcribed and translated to the greatest possible resemblance, taking account of the colloquial language used by the teens. According to Linell (1994) there are two main issues to be considered when transcribing. The first involves "authenticity", which means that the transcription should present what is said and not follow the rules of grammar etc. of the written language. The second concerns "practicality", meaning that the question of details should be decided in relation to the aim of the study and to making the transcription readable.

Students who participated in the focus group interviews were simply selected based on willingness and keenness, and no further considerations regarding group dynamics were taken. In most cases, students with strong opinions wanted to take part in the focus group interviews. In other cases, the main motivation to be interviewed seemed to be to skip time in class. Overall, the students who were interviewed were a rather heterogenous group.

Interviews were held with boys and girls and with students of varied school performance and classroom behavior. In some groups, students had a lot of opinions and spoke rather freely, elaborating their answers and discussing with each other. In other groups, students were silent, answering questions only with short answers. In general, the seventh graders were more open and talkative, however in one of the groups of seventh graders a majority of the students answered only with yes or no and kept very silent during the complete interview.

The two individual interviews conducted with the respective teachers lasted 34 respectively 62 minutes. During these interviews, the teachers discussed various matters and several follow-up questions took place. The teachers were more eager than the students to air their ideas and seemed more comfortable in stating their opinions.

Classroom observations were performed to gain insight on how students and teachers interact with digital tools, as well as observing difficulties and possibilities with digital tools usage. Before the observations, an observation framework was produced. This framework can be found in Appendix B. The focus of the observations regarded possibilities and challenges emerging in the classroom when digital tools where used, and communication and interaction between students, teachers and digital tools.

The observations were carried out during one English class and two different social science classes, in a total of seven observation occasions. The students in the English class were in the ninth grade, hence 15 through 16 years old, and the students in the social science classes were in the seventh grade, hence 13 through 14 years old. One teacher taught the English class, and a second teacher taught both of the social science classes. Henceforth in this thesis, the classes are named 9A for the ninth grade English class, and 7A respectively 7B for the two seventh grade social science classes. The teachers will be referred to as teacher 1, the English teacher, and teacher 2, the social science teacher. Observations were written down by hand and after the class transcribed in a word processing document.

4.5 Ethical considerations

The study follows the Swedish research council's (2017) ethical guidelines and ethical rules in social science research, i.e. requirements for *confidentiality, consent, information* and *autonomy*.

All students were informed about the purpose of the study and that it was completely voluntary to participate. They were also notified that if they first stated that they wanted to participate they could choose to end their participation whenever. They were thereafter provided with consent forms to sign approval to participate in the study. The seventh-grade students were given one consent form for themselves to sign, and one consent for their guardian(s) to sign. Ninth grade student, all of them having turned 15, were given one consent form for themselves to sign, and one information letter to notify their guardian(s). Additionally, the teachers were given one consent form each. All variants of consent forms and the letter are attached in Appendix C. All ninth-grade students but one of those who were present when handing out the consent forms signed their approval directly. In total, two students in the class did not sign the consent forms. From the seventh-graders, several students forgot to bring their consent forms home. Some students took an active choice not to participate, some did not really seem to understand the aim of the project, and some simply ignored it. The students who did not sign the consent forms, or whose guardian(s) did not

sign, were of course excluded from the data collection. No names nor the name of the school are mentioned in the study. Furthermore, consideration has been taken so that it should be difficult for persons not directly involved in the study to recognize the students and teachers.

The data collection was attempted to be performed impartially. The aim was to, as an interviewer and observer, have an open mind and not actively search for confirmation of preconceived ideas.

5. Findings

In this chapter, results from seven unstructured observations and seven semi-structured interviews with students and teachers, as well as some informal conversations with the assistant principal are presented. The results are analyzed based on the research questions in terms of possibilities and challenges that the teachers and students describe in the classroom activities when digital tools are utilized. These aspects are considered in terms of what emerges through the respondets utterances as significant structuring recourses for work with digital tools in the classroom activities. The thematic analysis (Braun & Clarke, 2006; Clarke & Braun, 2017) showed that the patterns of meaning in the teachers' and the students' answers could be categorized in three qualitatively different themes of possibilities and four themes related to the described challenges. The seven themes are presented through excerpts from interviews and observations from the classrooms.

In table 2 below the themes of possiblities and challenges that stucture the work with digital tools according to the teachers and students are presented.

Table 2 – Themes related to possibilities and challenges

Possibilities	Organizing learning
	Supportive opportunities for the teacher
	Possibilities with the subject specific teaching material
Challenges	Technical problems
	Decreased learning opportunities
	Difficulties for the teacher
	Challenges with the subject specific teaching material

5.1 Possibilities

5.1.1 Organizing learning

This theme involves different kinds of arguments concerning how digital tools make the organizational aspects of education and learning easier such as arranging educational material, enabling possibilities of individualization and creativity. The teachers mention how the organization becomes simpler in terms of how the digital tools enable planning, follow up-routines, communication with students and make documentation much easier. Illustrative examples of how the respondents maintain that some of the possibilities with digital tools are developed ways of organizing learning follow below.

Excerpt 1.1   That is the advantage of digital tools. You can keep everything simple and remove all the fuss. (Teacher 1)

Excerpt 1.2   With quizzes and questions that are answered on a digital device, students can be anonymous and not only the best students answer. (Teacher 2)

Excerpt 1.3   When students with difficulties get adapted material on their tools, they are not as stigmatized as if they would have gotten the material as a book or a paper. (Teacher 2)

Excerpt 1.4   It seems more atomized and better since you can get more help. For example, if you find it hard to read you can listen and that is not possible with a book. You can adapt your learning to what you like. (Student interview 1, 9A)

Excerpt 1.5   There is a planning and for each class so we know what we have to do and can do it at home. (Student interview 2, 9A)

Excerpt 1.6   Digital tools are great, it is so nice not having to walk around with extra books. (Student interview 1, 7A)

The teachers do not state that they can detect clear sign of enhanced nor decreased learning. However, digital tools facilitate different methods that *may* enhance teaching and learning. A main structuring recourse for the teachers could analytically be seen to be the simplicity that comes with digital tools which eases the need for control (Excerpt 1.1). The possibility to have full control lowers stress levels, which teacher 1 believes students can notice in everything that happens in the classroom. Further, digital tools are understood to become structuring resources in two ways according to teacher 2 (Excerpt 1.2). First, all students work on the same tools avoiding stigmatization, and secondly, the digital tools open up for individualization and personal adaptions. Students do not have to leave their group to get some form of adaption since it happens digitally. Teacher 2 argues that flexible services for adaption enabled by digital tools avoid discriminating the students. Moreover, when some students have to get different physical material, it becomes more stigmatized than it does if it can pass digitally (Excerpt 1.3).

Organizing individualization is mentioned by both teachers in terms of how the digital tools enable individual tracks for the students' learning. Options like texts in students' mother tongues, legible texts and speech synthesis can help students that need extra support, or students that simply learn better with certain methods. One example where students can control their own learning is found in observations of the ninth-grade English classroom. Students watched a video on YouTube, and everyone watched on their own digital tools with headphones on. Some students rewind several times, while others started with the subsequent assignment after watching the video only once. They also had the option of watching the video again, whilst working on the assignment. In interviews, the students also acknowledged that there are more possibilities for individualized aid, for example by listening to a text if it is hard to read for someone. They can adapt their learning to their preferences (Excerpt 1.4).

In terms of organizing the work, it is obvious in analyzing the statements by the students that both the opportunities that digital tools enable and the tablets as such become structuring recourses both to prepare for the activities, and in the activities. Since all material is available online, students who missed a class or prefer repetition can easily find it. Ninth-grade students like that they always know exactly what they need to do before next class not to get behind (Excerpt 1.5). Knowledge demands, goals and progress are easy to detect and follow in the systems. This transparency between students and teachers enables students to take greater control over their own learning. The possibilities to organize that is enabled by digital tools could analytically be seen as an overall structuring recourse for both the students and the teachers. The students also mention that they like working with digital material instead of carrying books for different subjects back and forth between home and school. Ninth-grade students appreciate the flexibility of a tablet and that it is easy to walk around with (Excerpt

1.6). From interviews, ninth-grade students claim that they usually take notes on paper but work with assignments and texts on their tablets. The facilitation of handing in assignments online and not having to worry about finding a teacher in person or losing important papers, is part of the organizational structuring recourses that the digital tools enable.

Another aspect that is mentioned by the respondents in relation to enhancing organization is creativity:

Excerpt 1.7   Tablets are more creative [compared to computers], they have more functions. You can take pictures, draw in the pictures, write together in documents etc. (Student interview 1, 7B)

Excerpt 1.8   It is easier to be more creative on a tablet than on a Chromebook. With a tablet, you can record, take photos, and edit in a different way. (Teacher 1)

Both the teachers and the students maintain that tablets enable creativity since you can do more creative things with that tool than with a computer (Excerpt 1.7, 1.8). From observations, however, not that much creativity can be seen. Students in all of the observed classes sit on their chairs, writing, reading and searching for information on their tablets. Students do not take pictures, record videos, draw, or walk around with their tools in any of the observed lessons. However, students and teachers acknowledge that tablets clearly *can* be used more creatively. In this sense the tablets are thought of as a means for creativity, but this was not obvious during observations, and could thereby not be understood as a strucrturing resourse. The school's assistant principle mentions that a tablet is a tool for creativity involving video recording, taking photos and editing (Personal communication, March 31, 2019). Other examples are teacher 1, who says that digital tools are hoped to enhance language development in a playful way. Teacher 1 agrees with seventh-grade students who state that they believe that their digital tools are creative, having different functions such as taking pictures and drawing in the pictures (Excerpt 1.7, 1.8).

Sharing content is also mentioned by the respondents. Sharing is described as an exploited advantage that comes with the use of digital tools, while creativity is merely mentioned as a possibility that is inherent in the tool.

Excerpt 1.9   It is easy to share documents, write together in documents and communicate by that. Everyone can work from home in the same document. (Student interview 1, 9A)

Excerpt 1.10 Google classroom is good! You can write and hand in at the same place, and the documents are already shared with our teacher. (Student interview 1, 9A)

Excerpt 1.11 If you are going to write a paper where you need facts, you can search and look at different pages to get several perspectives. (Student interview 2, 9A)

Students in several interview groups mention that they know that it is possible to share texts and write simultaneously with others. The sharing aspects of the hardware and software thus seem to become structuring resources in collaboration and communication (Excerpt 1.9). Ninth-grade students think that it is easier to share documents between each other and

teachers. When they work with Google classroom they can write and hand in on the same place, and the documents are already shared with the teacher (Excerpt 1.10). They also like that they can work together from separate locations and communicate with each other in a document. Important structuring resources enabled by the digital tools is, hence, the easiness to collaborate, i.e. that the tools allow students to work together online, facilitate communication between students and between students and teachers.

Ninth-grade students do not completely trust everything that they find on the Internet, and sometimes ask the teacher if what they find online is correct. When they are writing essays or papers, they appreciate the possibility to search for facts online (Excerpt 1.11). According to students, working on a digital tool implies that it is easy to gather information and research a subject from different aspects, which analytically is understood as enabling structuring resources for their work.

5.1.2 Supportive opportunities of the teacher

This theme presents the teachers' view of their own roles. They mention that their education is not fundamentally changed with educational IT and claim that their role in the classroom is quite similar to that in an analogue classroom. While activities outside of the classroom are enhanced and may become simpler by digital tools, teachers in their physical presence scaffold students and are thereby understood as the most important structuring resource for students' learning processes. Below, teacher's opinions on digital tools as supportive opportunities in the teaching process are presented.

Excerpt 2.1   The goal is not to digitalize the product or service in itself, it is to create simplicity in communication, share projects, and systematically introduce digital tools. The school should not aim for that either, education is still education but everything around it can become easier. (Teacher 1)

Excerpt 2.2   I do not think that planning and pedagogy changes that much. What I would have done analogously is transferred to become digital. (Teacher 2)

Excerpt 2.3   I become the technician! (Teacher 1)

Excerpt 2.4   When I do not teach a class, I am super digital, but when I am with my students in the classroom, I have to be analogue because I have to be present and have a relation to my students. (Teacher 1)

Excerpt 2.5   I like to test new things, but I also like the structure that exists when you do the same things and use the same resources over and over again. I try to find the balance between doing new things because it is fun and doing the same things because it is nice for the students to know what is happening. (Teacher 1)

Excerpt 2.6   I think that the students mostly go to me for help. Very few students search for help online. Even in assignments when they are supposed to find information on their own, the easiest way is still to ask me. (Teacher 1)

While the digitalization of school is indeed a difficult process and an area where many teachers may feel lost, teacher 1 compares it to the digitalization of companies (Excerpt 2.1). While many teachers might think that they have to fundamentally change their teaching, the teachers in this study have a different view, claiming that their teaching looks quite similar. Teacher 2 thinks that it is rather convenient to simply transfer what would have been done analogously in a classroom to make it digital and does not believe that planning and pedagogy changes extensively (Excerpt 2.2). When teacher 1, who has taught for ten years, is asked if the role of the teacher has changed with the digitalization, the response is preceded by a laugh (Excerpt 2.3) and the claim that the teacher role now also includes having to deal with technical issues.

While there is a big difference in the work done before and after class, with planning, access, assessment and communication, the teacher role in the classroom seems rather unaltered. It is obvious that the digital tools become structuring resources for the teachers in the extensive amount of their work that happens outside of their teaching in the classroom. Thus, more in the planning of the teaching than in the teaching activities as such. Teacher 1 describes a difficulty in being digital in the classroom, as a relation to the students is necessary (Excerpt 2.4). However, being digital outside the classroom is easier. Teacher 1's planning and execution of lessons has changed during the last ten years, however more because of professional development than digital techniques. There is always time reserved to technical issues, something that does not seem to happen very often during any of the observed classes. Thus, these kinds of experiences interplay with the teachers planning for the lesson and thereby become structuring recourses for how the work is conducted.

In the interviews, both of the teachers express that they are receptive to new resources and do not mind trying new applications or software. Teacher 1 focuses on keeping a routine in the use of resources (Excerpt 2.5). The teacher develops this argument by also arguing that students can get stressed when new things happen all the time. It helps some students to be in control of the tools and the material. Teacher 1 describes that digital applications in the classroom make activities fun, but also argues that having a known arrangement and organisation is important for the students' work. Thereby, a balance of new positive experience making the work enjoyable and more habitual organized activities become important structuring resource for the teachers work in the digital classroom.
According to students, the teachers are still their primary means for support in the classroom. This can be seen also from observations in all of the classrooms, as students often raise their hands and call for the teacher's attention before turning to a classmate or searching for information on their tablets. Teacher 1 agrees with this, claiming that students still seem to think that turning to the teacher is the easiest way to get information or a correct answer (Excerpt 2.6). Teachers are understood to be the main structuring resource for students when they need help in the classroom.

5.1.3 Possibilities of the subject specific teaching material

The digital teaching material used at the school is provided by the previously mentioned company Gleerups. The observed school is a pilot school and tests the digital teaching material in return for feedback. In the seventh-grade social science classes, Gleerups is used during essentially every observed lesson. In the ninth-grade English class, Gleerups is only used for additional assignments for students who are done with primary assignments. The seventh-grade students and ninth-grade students, along with their respective teachers, have

very differentiating opinions on the matter. In this theme, positive aspects of the material are presented. Arguments presented by teachers and students include good exercises, access to comprehensive content, and helpful functions.

Excerpt 3.1   It is easy to find things in Gleerups, for example search for concepts of articles. It is easy to move around if you know where you are going. The material really contains what you need to know, and it is good that you can choose basic text or legible text. (Student interview 1, 7B)

Excerpt 3.2   Everything is done thoroughly, there is not that much that they can get better at. (Student interview 1, 7B)

Excerpt 3.3   The exercises are good, fun and easy and the teacher can clearly see if we have done them or not. (Student interview 1, 7A)

Excerpt 3.4   It is good that there are legible texts and that you can listen to them. (Student interview 1, 9A)

Excerpt 3.5   I think Gleerups is good because everything is in the same place. You do not have to go to different websites or carry around different books, since everything is at Gleerups. (Student interview 1, 7B)

Excerpt 3.6   It is good for studying because in the past you could forget books at school that you needed to study for an exam. Now that is not a problem. (Student interview 1, 7B)

A general opinion of the seventh-grade students is that their subject specific teaching material works well (Excerpt 3.1, 3.2). Hence, the digital teaching material could be seen as part of the structuring resources for their learning activities, in the way that they find it enjoyable. They especially seem to like the exercises, and the fact that their teachers can follow their progress with the material (Excerpt 3.3). Ninth-grade students are not quite as satisfied with Gleerups, however they like some things about the digital teaching material, including the option of reading extra legible texts, listening to texts, and the quality of the exercises (Excerpt 3.4). Students appreciate the fact that all material is available on their tablets, which minimizes the risk of forgetting material either at home or at school (Excerpt 3.5, 3.6). The Gleerups software covers all subjects and is available on any digital tool. This accessibility is analytically understood as a structuring resource for the students in always having their study material nearby.

Excerpt 3.7   It is okay, there is a good plan and a thought behind it. Everything is gathered on the same place which is convenient. (Teacher 2)

Excerpt 3.8   I have understood that the material in my subject is one of the better. All teaching material will miss something or focus on the "wrong" stuff. For me, it does not really matter who the producer is. (Teacher 2)

Excerpt 3.9   I will sometimes add extra assignments or list of concepts. I usually use Gleerups' lists for that, as they often include good concepts. (Teacher 2)

Excerpt 3.10 The assignments are good and connected to the students' abilities. There is a good level on the tests. It is still good for students who are done with their assignments. (Teacher 1)

As teacher 2 is quite new to the teacher profession there is not so much to compare with in regard to teaching material. Considering, teacher 2 thinks that Gleerups works rather well. A main thing that is discussed during the interview is the clear plan and intention of how the material is used over a semester or several school years (Excerpt 3.7). From several informal conversations as well as from interviews with students and various teachers, it is clear to see the perception that the subject specific digital teaching material is of varying quality depending on subject. The material for social science is several times mentioned to be one of the better ones, which teacher 2 is aware of (Excerpt 3.8). The teacher has a hard time imagining the perfect material, thinking that all material from any producer will have some defects. Based on this, teacher 2 almost always uses Gleerups as a basis and the setup that exists, however sometimes uses other recourses to complement and enrich certain concepts or topics (Excerpt 3.9). Teacher 1 does not use Gleerups very much this semester, however last semester it was more clearly implemented in the education. Sometimes, students who are done early complete assignments on Gleerups (Excerpt 3.10).

The seventh-graders are aware of various functions in Gleerups such as highlighting text, changing the font and choosing a different-colored background. From observations, it is clear to see that several students in both 7A and 7B change the background and/or the font in Gleerups. Only one student is observed listening to the text during lessons, but one of the students in the interview sometimes listens to and reads text simultaneously while studying. The various functions could be seen as structuring resources for the students but if they really are is hard to decide without more thoroughly exploring the activities.

5.2 Challenges

5.2.1 Technical problems

A theme that is mentioned by both students and teachers several times during interviews is the issue of technical problems. When digital tools do not work, interruptions are introduced. Some students even mention an occasion when they were sent home because of the lack of internet connection. Teachers schedule extra time for various technical problems.

Excerpt 4.1   A challenge is if the technology is not working, wi-fi is off, then we cannot do some parts of the class. One time we had to share our cellular data to work in Gleerups, or work on our phones. Then you get notifications from different apps and get stuck there. (Student interview 1, 7A)

Excerpt 4.2   I have always scheduled time for technical issues. It was a much bigger problem ten years ago, with for example computers that did not start. There is always some hassle, almost nothing just runs smoothly by itself. (Teacher 1)

When students are asked what they think is challenging or bad with digital tools, there is one common denominator in all interview groups; technical issues (Excerpt 4.1). Lack of technical support or stable infrastructure implies that they experience that digital tools can hinder their work flow. Teacher 1 always accounts time for technical interruptions in planning the lessons (Excerpt 4.2). With improved software and hardware, the digital tools could become a structuring resource for smooth work flow in the classroom. The better developed resources that are used, the less hassle will they create for students and teachers, but this would also depend on more stable internet connection. It is here shown that the teachers' preparation, which involve knowledge of possible disruptions, is important in the teachers' planning of lessons to avoid unnecessary interruptions. This means that involved in their work and planning they have to count on some technical issues, which is more likely the aspect that becomes a structuring resource invoked in the activities.

5.2.2 Decreased learning opportunities

This theme discusses various matters perceived by students and/or teachers as decreased learning opportunities. A main challenge of digital tools, and specifically digital devices, especially in the younger ages, seems to be the matter of distraction. Teachers consider this issue to reach beyond restrictions and discuss going deeper to meet the problem by for example educating students in digital health, i.e. creating healthy usage of their digital devices. Ninth-graders find looking at social media applications on their mobile phones or tablets to be a convenient break from school work, while seventh-graders acknowledge that an extra device becomes yet another distraction. Finally, students consider challenges of the tablet as a tool, where they believe that it complicates group work, decreases spelling competence, and makes reading more difficult. Examples of how respondents stress that some of the challenges with digital tools decrease learning follow below.

Excerpt 5.1   Weak students or students with difficulties can barely even handle it. Many students get distracted and do something that they think is more fun. (Teacher 2)

Excerpt 5.2   You get distracted by someone else playing. 'Look what I did', and then you start talking about it. (Student interview 1, 7B)

Excerpt 5.3   - You could not play on them.
- But that is good! (Student interview 1, 7B)

Excerpt 5.4   If they cannot download Snapchat, they start using Airdrop. They will always find a way around the restrictions we give them… (Teacher 2)

Excerpt 5.5   A book can just be put in front of a student with the right page open. It is harder with digital teaching material. (Teacher 2)

Excerpt 5.6   For example, removing mobile phones just delays the real issue to upper secondary school or even university. When will they be taught about it when their parents do not take responsibility? I think this is a compensatory mission for the school. (Teacher 1)

One aspect where the opinions of seventh and ninth-grade students differ is the discussion on digital devices as distractions. Seventh-graders, as well as their teacher, are very aware that distraction is an extensive challenge. The teacher considers this to be the main difficulty of digital tools in the classroom and claims that none of the seventh-grade students can handle working alone on their tablets to a full extent (Excerpt 5.1). The seventh-graders feel like they are easily distracted and often end up browsing different applications or websites. From the classroom observations in the seventh-grade classes, it is clear that the students are distracted by the attractions on their tablets. Frequently used applications are Snapchat, YouTube and Netflix, and also googling different matters unrelated to school work. They watch things together and often want to show their friends what is happening on their screen (Excerpt 5.2). At the same time, students believe that classmates who would have disturbed without a tablet do not do it to the same extent now, since they instead are focused on playing on their tools.

The awareness that seventh-graders have of their own distraction from tablets is apparent in especially one interview. When discussing various digital tools, students mention that Chromebooks are more limited regarding applications and games, and that it might make it easier for them to concentrate. One student dislikes the fact that it is harder to download applications and games on a Chromebook, a statement that is immediately protested by a classmate (Excerpt 5.3). Hence, they are very aware that the tablet could distract them from doing school work, which is displayed by their reasoning. They want help in learning to handle the tools properly and the school has also done a few attempts in that direction, for example implemented screen time on the students' devices, which can limit time on certain applications and hours during which applications can be accessed. However, students find ways to get past these restrictions, for example by modifying the clock or changing time zones, and teacher 2 expresses the need to see past the problems and realize that these kinds of technical restrictions are often evaded by the students (Excerpt 5.4). The seventh-grade students agree with this, confessing that they usually find a way around restrictions. Teacher 2 mentions the fact that the tool itself is a source of distraction, claiming that everything that is hindering learning should be removed, and that analogue teaching material would work better in that sense (Excerpt 5.5).

Teacher 1 argues that the school has a complementary mission in teaching students how to develop good digital health. To remove disturbing moments simplifies the problem and prevents them from learning to handle the tools (Excerpt 5.6). The teacher also discusses that many parents lack knowledge of methods that can be implemented to foster good digital health, and particularly points to the important goal of schools to be compensatory.

Excerpt 5.7   Teachers say that it disturbs you to check you phone and that it takes 20 minutes to get your focus back. I think it depends on who you are. For me, I have my phone on vibration, and I just look at the phone, put it down and start working again. (Student interview, 9A)

Excerpt 5.8   I think it is good. Not many people sit and use them, but it can become a moment of distraction if you have them on the table. If you have it in the pocket shut it off that does not happen. (Student interview 1, 9A)

The ninth-graders have slightly different ideas about the issue of distraction. In interviews, it is clear that they do not experience the tablets nor their phones to be very disturbing. One

group state that they rarely do things that are not related to school work on their tablets, but that it does happen every now and then. The other group state that they never look at other things on their when they are not actively working on it. However, from classroom observations it can be seen that a majority of the students, including those being interviewed, use their tablets for other things than school work in the classroom. The most visited applications are Snapchat, Instagram, Spotify and YouTube. Even though various applications are looked at and discussed with classmates, it does not seem to bother them as much as it does the seventh-grade students. Once they have scrolled through Instagram or switched songs on Spotify, they return to their assignment and regain focus (Excerpt 5.7). Ninth-grade students have an overall positive attitude towards being allowed to bring their phones to the classroom, stating that as long as phones are put away and on silent, they are not a disturbing factor (Excerpt 5.8). For ninth-graders, looking at their mobile phones seems more like a small break from the school work. In this sense, their tools could be understood as structuring resources in offering pauses from school work. Seventh-graders, on the other hand, are uncertain whether or not phones should be allowed in the classroom. They believe that it is easier to play on a phone without a teacher catching them.

Excerpt 5.9   It was easier to sit in a group with a book, and much more fun. If one person has a book, and one takes notes, and everyone sits and talk and work together, then you have different roles, are more active and engaged since everyone focuses on the same thing. (Student interview 1, 7B)

Excerpt 5.10   If everyone has a tablet, and five people are working on their tablets in a good way, and the last one is playing a game, then that person distracts everyone else that are actually trying to work. (Student interview 1, 7B)

Excerpt 5.11   Before this, you didn't really acknowledge the help you got [from the spell checker/word processor]. After this you can notice a big difference. (Student interview 2, 9A)

When one of the interviews with seventh-graders moves into the topic of group work, students mention that the tablets complicate collaboration (Excerpt 5.9). Now that each student has their own tool, they turn their focus towards that, making group work more individual. The students believe that when working with a book as the main source of information, each student gets a specific role, which results in them having to collaborate to take part of each other's roles. They also reflect on the fact that if only one student in a group is looking at something on the tablet that they want to share with the classmates, it is very easy for the rest of the group to get distracted as well (Excerpt 5.10). In the observed seventh-grade classes, no organized group work is performed. However, sometimes students who sit next to each other work on assignments together. Repeatedly, the students look at applications or video clips together, and other students run over to join or to show something on their own tablets. Students explain that they had more group work in previous grades, when they did not have individual tools. The tools can conceivably become structuring resources in fostering collaboration and communication through the software, however from observations in the seventh-grade classroom this is understood as occurring more as a distraction.

A specific aspect of language learning in connection to educational IT that is brought up by both students and teachers, is the decreased spelling ability. During exams in the ninth grade,

the application ChromEx[7] has been used, with no activated spell checker. Students reflect on this during interviews (Excerpt 5.11). They feel as if they do not learn how to spell properly when writing on their tablets, but it does not concern them too much. In this sense, the spell checker and in extension the tool becomes a structuring resource for students spelling. Teacher 1 expresses that even the students with the best grades appeared not to be able to spell correctly.

Excerpt 5.12 Sometimes I take notes on the tablet since it is connected to my phone and I can see the more important things there. If it is questions and answers or something like that that is not as important, I usually write in a note book. (Student interview 1, 7A)

Excerpt 5.13 The tablet seems like a way to make everything less clumsy. The computer takes longer to start, but once you are up and running it is fast. You can do more on a computer and learn more. (Student interview 1, 9A)

Excerpt 5.14 I usually get a headache; I can sit for half an hour maximum then I need a break. (Student interview 1, 9A)

Excerpt 5.15 I think it is hard, because it is so easy to think about something else. You get bored. It is easier to read on a paper. (Student interview 2, 7B)

Excerpt 5.16 You have to start using them [digital tools], and then demand that the students bring them, rather than demanding that students bring them and then start using them. Then there is no reason for students to bring them. (Teacher 1)

Not all students express content with using only a tablet as a work tool. It can be seen from observations that many students, especially those in seventh grade, take notes in notebooks. In interviews students discuss taking notes on tablets versus taking notes in notebooks (Excerpt 5.12). Students who are critical towards tablet-work express that several teachers have told them that they will learn better if they write by hand. Some teachers want the students to only take notes by hand. One student in ninth grade thinks that it is harder to focus on taking notes on a tablet than on paper when the teacher is lecturing at the same time.

During interviews, ninth-grade students express concerns about using tablets. They claim that they will, in the future, work on computers and feel an urge to learn how to write on a real keyboard. They think that it is easier to do certain things on a computer, e.g. doing several things simultaneously, jumping between windows/applications and creating tablets in documents (Excerpt 5.13). Here the student mention that even though they would prefer a computer, the tablet as such is better due to its smoth design and rapid processor. One disadvantage of digital tools in general that several students mention is the issue of reading on a screen as it is annoying for the eyes to constantly look at a screen. Some of the ninth-graders argue that they sometimes get a headache from looking at a screen for too long (Excerpt 5.14), hence invoking a medical aspect. They also think that it is hard to stop reading in the middle of a text, not being able to leave a bookmark as in an ordinary book. Several ninth-

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[7] https://www.chromex.io, an application for digital exams.

graders agree that analogue books to read in and digital tool to work in would be a good compromise. Another student in grade seven thinks that it feels more correct with a book, and also that when they answer questions and take notes on the tablet, changing windows is annoying and might result in the wrong tab or window showing up, distracting them from the assignment. Distraction when reading on a screen in mentioned by several students (Excerpt 5.15). Thus, in terms of how the students discuss distraction, headache, and other challenges, these premises of digital tools in general and tablets in particular become structuring resources in the students' work with the tools.

Even though students in all interviews express that a tablet is a handy, easy-to-bring tool, several students in all of the observed classes either forget to bring or charge their tablets. Both teachers acknowledge that flexibility is important and let student work on the mobile phones or work together with a friend. Students mainly think that it is good that they are allowed to work on their phones, otherwise they experience that they miss a big part of the class. Teacher 1 emphasizes that teachers cannot expect students to bring their tablets if they do not use them during class (Excerpt 5.16).

5.2.3 Difficulties for the teacher

The participating teachers of this study have a generally positive view of digital tools, however, some main difficulties perceived by teacher 2, that seem to be shared with colleagues at the school, are presented below.

Excerpt 6.1   The gab is mostly 'we should forbid everything' or 'it works fine for me'. Me myself do not hate it and think that it is similar to other options. (Teacher 2)

Excerpt 6.2   Other teachers, and me, see the workload as a hinder. It is hard to gain insight or knowledge on something new. If we are going to do this, we need more support and education from the school. It cannot just be up to me and on my own time because then it does not get done. (Teacher 2)

Opinions amongst the colleagues are divided into two opposing sides (Excerpt 6.1). Some teachers do not want to use digital tools at all, while some think that it works quite well. Teacher 2 believes that the work load is a main obstacle for teachers who are reluctant towards fully implementing digital tools for learning and teaching in their education (Excerpt 6.2). The teacher seeks more support and education from the school, as well as clear guidelines. This relates also to how students work with the tools, and to create consensus in rules and usage. This would help teachers and students in classroom activities. With more knowledge and better support teacher 2 thinks that the hardware and software will function better and then they could be structuring resources for more efficient work.

5.2.4 Challenges with the subject specific teaching material

As previously mentioned, opinions about the subject specific digital teaching material vary widely. Ninth-graders raise issues such as slow software, hard to get around, repetitive material, and intricate information. Illustrative cases of how respondents assert that the digital teaching material creates challenges in the learning processes follow below.

Excerpt 7.1   It sucks. It takes a long time to load, it is hard to find you way around, there are too many unnecessary things that you do not need to know, and sometimes the texts tell us the wrong information. (Student interview 1, 9A)

Excerpt 7.2   Gleerups does not always work very well. It is slow, boring, hard to find things, dull, there is basically nothing positive. The fact is also bad. (Student interview 2, 9A)

Excerpt 7.3   It is the same thing all the time. Read a text, answer questions... (Student interview 2, 9A)

Excerpt 7.4   The exercises feel a bit unnecessary. You sit and match things, it does not feel so worthwhile... (Student interview 1, 9A)

Excerpt 7.5   Sometimes I do not understand what they mean, they explain much better in the physical book. The texts are long but sometimes it feels as if they shortened it down and removed certain parts to add better sentences. (Student interview 1, 9A)

From observations and interviews, it is clear to see that ninth-graders have an overall negative view on the material (Excerpt 7.1, 7.2). The ninth-grade English class does not use Gleerups as the main source of material during this semester, however they did during the previous semester and students sometimes do exercises on Gleerups when they are done with primary assignments in class. During classroom observations, ninth-grade students express their feelings about the digital teaching material very clearly, stating that they do not want to work on Gleerups and coming up with excuses to why they should not have to. In the focus group interviews, students express similar opinions. Students think that the software is slow and that they often have to sit and wait for it to load during several minutes (Excerpt 7.1, 7.2). Working with the digital teaching material involves that the students have to wait for it to load and take that into account when working with the software, which is understood as a structuring resource in the activities.

When further discussing the material in Gleerups, some ninth-grade students complain on exercises (Excerpt 7.3 & 7.4) and the information and content (Excerpt 7.5). Students claim that exercises look very similar in several chapters or units, and that they are not very stimulating. They are dissatisfied with the text in Gleerups' digital material, comparing it to the analogue that they believe is better.

Excerpt 7.6   It is hard to find the right things in "the books". There is no clear table of content and imagine that you have one program with like 12 different books to go through. (Student interview 1, 9A)

Excerpt 7.7   The search engine is bad. You get the explanation in a tiny paragraph, but it is not easy to find the right chapter. (Student interview 1, 9A)

Excerpt 7.8   Students have to sign in all the time. If they do something else and then they are signed out, which is a hinder. Moving around trying to find different things

is complicated and it is easy to get lost. It could have been much more user-friendly, and this target group needs something that is as simple as possible to use. (Teacher 2)

Excerpt 7.9   I do not think they are simple, which is the most important thing! It has to simplify. (Teacher 1)

The issue of finding the correct information and searching for facts is repeatedly mentioned (Excerpt 7.6, 7.7). Students perceive the search engine that exists in the software to be inadequate, as well as the lack of a clear table of content. When searching for one or several words in Gleerups, the chapter and the sentence or sentences where the words arrive show up in a list. Hits from all units and all chapters are presented in the list. According to students, working on Gleerups indicates spending extra time for searching on information on a subject or concept, and knowing this can be seen as a structuring resource for their work. Teacher 2 mentions issues with the user-friendliness (Excerpt 7.8). Teacher 1 agrees, emphasizing the importance of simplicity when working with digital tools for educational purposes (Excerpt 7.9).

Overall, findings from interviews and observations show that teachers and students identify several possibilities and challenges with digital tools and educational IT. Three main themes discussing possibilities have been presented in this chapter. These themes are organizing learning, supportive opportunities for the teacher, and possibilities with the subject specific teaching material. The four themes discussing challenges with digital tools in the classroom are technical problems, decreased learning opportunities, difficulties for the teacher, and challenges with the subject specific teaching material. Hence, soma aspects, for example the teaching material, is seen as a challenge in some aspects and a possibility in other.

6 Discussion

The overall purpose of this study has been to explore possibilities and challenges in the digital classrooms of a secondary school. More specifically the research was conducted to explore teachers' and students' perceived possibilities and challenges in learning activities mediated by digital tools, with the analytical focus to examine what becomes significant structuring recourses in this practice.

6.1 Possibilities and challenges that teachers and students consider emerge when classroom activities are mediated by digital tools

From the findings that were classified into themes which subsequently were separated into possibilities and challenges, it became clear that three main perceived possibilities were found. These were possibilities in terms of (i) organizing learning (ii), supportive opportunities for the teacher and (iii) possibilities with the subject specific teaching material. The analytical classification further showed four main themes related to challenges; (i) technical problems (ii) decreased learning opportunities (iii), difficulties for the teacher and (iiii) challenges with the subject specific teaching material. From the findings, it could further be seen that several subthemes appeared as both possibilities and challenges. Generally, this was based on students' and teachers' sometimes contradictory opinions. Some main differentiating opinions were that ninth-graders and their teacher generally considered digital tools as means for organizing and simplifying learning, while seventh-graders and their teacher mostly perceived digital tools as a source of distraction and disturbance.

6.1.1 Possibilities

The findings related to possiblities for students and teachers to organize learning activities involved for example planning, follow up-routines, communication, sharing and individualization. Further, teacher 1 and the ninth-grade students believed that having access to material beforehand and the possibility of always knowing what is going to happen and what has happened during a class, creates control (Excerpt 1.5). These findings are in line with previous research suggesting that digital teaching materials commonly contain various functions that can support teachers and students in learning activities (Grönlund & Wiklund, 2018). Previous research from Haelermans (2017), also points out that IT provides effective possibilities for individualization and individual learning paths, which was also one important aspect involved in the theme organizing learning of this study. This was however not clearly seen during observations, which is in accordance with the study by Grönlund and Wiklund (2018), whose results show that even though much digital material have these functions, it does not determine that they are used at all or how they are used. Digital tools and specifically the subject specific digital teaching material used in the observed school do enable individual tracks for students' learning, as it is easy for teachers to follow progress. Other possibilities for individualization were, for example, discussed by teacher 2, claiming that digital tools can enable individual material without stigmatization (Excerpt 1.3), which was equally not clearly seen in the observed classes. This implies that knowledge of various digital functions offered by teaching material and ideas of individualization were evident in the teachers' and students' discussions about the digital tools more than revealed in the activities at the observed school, hence more in theory than in practice. Some students were aware of how to change colors and fonts in their subject specific digital teaching material; however, this seemed to be more out of curiosity than out of learning purposes. Students were never provided with individually adapted material; still, they knew that they themselves could choose to listen to information or

read legible texts on Gleerups (Excerpt 3.1). While it was not obvious during data collection, individualization is expressed by students and teachers in interviews to be a possibility of digital tools. (Excerpt 1.3, 1.4), in line with e.g. Haelermans (2017) and Sjödén (2014), claiming that digital teaching materials have opportunities to be individually adapted.

An additional perceived possibility in terms of organizing learning was collaboration. Students in this study were not seen to collaborate extensively during class. Ninth-graders mentioned collaboration only in the sense of possibilities for sharing information and content (Excerpt 1.9, 1.10). Seventh-grade students expressed that they performed more group work in their previous schools, where digital tools were not always present. The seventh-graders' opinions in this thesis was that tablets limit and hinder collaboration (Excerpt 5.9, 5.10). They referred to the tablet as a source of distraction, where it only takes one distracting student to affect the others extensively. In the study by Guðmundsdóttir et al. (2014), tablets are shown to support student collaboration and students acknowledge that it is easier to work together, in accordance with Hylén (2013), who claims that digital tools foster collaboration. Hence, findings from this study and results from previous research do not concur on the matter of collaboration as organizing learning in the digital classroom.

6.1.2 Challenges
The main challenge from the empirical material was distraction, which was mentioned several times during interviews with the seventh-graders and their teacher (Excerpt 5.1, 5.2, 5.5) and was also clearly observed in the seventh-grade classrooms. This was however not by far as apparent in the ninth-grade classroom. The matter of distraction highly assents with several studies that conclude that digital tools in the classroom can imply distraction (Hylén, 2013; Kontkanen et al., 2016; Lindberg et al., 2017). The general opinion of students and teachers in this thesis was that digital tools induce distraction, and not that tablets or mobile phones specifically were factors of distraction. It can be mentioned that the three above-mentioned studies performed research in comprehensive school through upper secondary school (Hylén, 2013) and upper secondary school (Kontkanen et al., 2016; Lindberg et al., 2017). The question of why the younger students stated distraction to be a far more extensive issue than the older students is interesting. Students' age in relation to how distraction is perceived would be an interesting topic for further investigation. Questions could then be raised whether the age as such is of significance or whether the fact that ninth-graders worked more consistently with digital tools gave them other habits. Still, some seventh-graders showed digital maturity in acknowledging that distraction is an issue with which they need help. This points to the importance of deliberately involving the digital tools as part of the tasks, enabling them to be part of the working activity instead of a tool to use for other things.

When a new tool is implemented in the classroom it could be hard to limit or find a solution to the issue of distraction. During observations, the tablets were constantly on students' desks, and if a teacher did not want them to use their tools for a section of the class, they were still a distraction, easy to pick up and look at, and lightning up whenever notifications were received. As the matter of distraction proved to be extensive, questions need to be raised on how to manage it. Whatever restrictions schools or teachers implement, e.g. screen time, teacher 2 believed that students will find ways to go around them (Excerpt 5.4). For example, if students are not allowed to download social media applications, they will use methods such as Airdrop to communicate. However, as Kontkanen et al. (2016) write, some students recognize that their digital tools offer relaxation between school work. This was the opinion

of some ninth-grade students in this thesis (Excerpt 5.7, 5.8). They did not seem to acknowledge the fact that they were using their tablets to take small breaks, as a strategy for continuing the activities. The most important question is how schools can make sure that all students work properly with tablets and distinguish that the distraction should be a short brake rather than the predominant time of a lesson. Teacher 1 discussed educating students in digital health, i.e. teaching students how to use digital tools in a way in which the tools function as learning aids rather than distractions. Importantly, to remember in the debate on digital tools as distracting is of course, that distraction can be caused by many different factors other than digital tools (cf., Kontkanen et al., 2016).

6.2 Significant structuring recourses for the work in the digital classroom

From the findings of this study, several aspects were analytically seen as structuring resources for teachers and students in the learning activities with digital tools in the classroom. A main structuring resource for the students were teachers' scaffolding, but the findings also showed other structuring resources. These were the digital tools' possibilities for individualization, sharing content, information gathering and accessibility. Digital tools also became structuring resources for teachers in planning, organizing and preparing classroom activities. In terms of distraction, headache, and other challenges, digital tools in general and tablets in particular became structuring resources that challenged the students' work on the device. Additionally, there were several aspects which students and teachers mentioned that could have been understood to function as structuring resources, which were not apparent during observations. For example, they believed that tablets and digital tools in general could become structuring resources for fostering enhanced creativity and collaboration, even though their resources were not clearly utilized in these ways.

While teachers acknowledged that digital tools could be structuring resources for individualization (Excerpt 1.3), this seems easier said than done as they did not clearly involve any activities that were particularly individually adjusted in their teaching. However, individual learning paths have been shown to create more pressure on teachers to produce different material for several students and research has shown that teachers for this reason avoid implementing more technological elements than needed, as it requires time (Guðmundsdóttir et al., 2014). Furthermore, previous research has also shown that teachers experience that finding relevant digital material for IT-supported lessons takes a lot of time (Lindberg et al., 2017). Selwyn (2019) writes that "digital technology is more of a headache for teachers than ever" (non-paginated webpage, in the introduction). As easy as it sounds to individualize students' learning with the help of digital tools, it will still require time and effort from the teachers. This complex role of teachers in connection to the framework TPACK will be discussed in a later paragraph. Hopefully, positive aspects of individualizing and user-friendly software can be reasons enough for teachers to individualize learning. Then, digital tools could be more obvious structuring resources for teachers in adapting material, and for students in having control over their learning processes. The tablets, or any other devices students may use, become mediating tools in remembering what has happened and possibilities for preparing for future lessons. Hence, one could claim that the digital tools could mediate and function as a structuring resource in various aspects of organizing learning activities.

Digital tools are also shown to be structuring resources in terms of more negative expectations of various activities in the classroom. Students' distraction is an example of this, as discussed

in a paragraph above. Students perceived this distraction to be mainly challenging but also sometimes positive. Hence, students' tablets mediated external distraction in a both positive and negative sense, and thereby functioned as structuring resources in those two ways. Teacher 1 emphasized the compensatory mission of the school in regard to minimizing distraction (Excerpt 5.5). If students learn how to manage digital tools at an early age, they will benefit from it all the way through their education and career. In line with the sociocultural perspective of learning, such adopting ways of working with digital tools become structuring resources for further learning activities.

Regardless of teachers' levels of TPACK, findings from this study show that the teachers' scaffolding are the students' main structuring resources in the classroom activities. These activities include helping with clarifications and concepts, but also supporting students in technical matters. It is seen both from interviews and observations that students often turn to their teachers for help with all kinds of matters. Liu et al. (2018) explain teachers are the most important factor in realizing the potential of digital tools, which is parallel with the findings of this study, implicating once again that teachers are the main structuring resource for the students work in the digital classroom.

6.2.1 Digitalization of education in policies related to TPACK

A few of the initiatives in the action plan delivered in March 2019 discuss the importance of equality and standards in access to digital education material (Sveriges kommuner och landsting, 2019). Education material publishers have an essential role in the standardization work as they are accountable for production of materials. According to the national action plan, digital teaching material and learning resources must be available, useful and effective in order to promote work situations for teachers (Sveriges kommuner och landsting, 2019). When this is not the case, teachers will create their own material, similar to the English teacher in this study. But for the digital tools in the classroom to be a fruitful tool for learning the teachers need adequate competence in implementing the tool with a clear purpose. Technological pedagogical content knowledge, TPACK, could then be seen as a necessary prerequisite for teachers' competence (Mishra & Koehler, 2006). Teachers hence need technological, content and pedagogical knowledge, as well as awareness of issues raised from intersections between the three dimensions. Without well-developed TPACK, teachers will have difficulties in designing effective teaching with IT. Teachers' varying level of TPACK and consequently the material they present to their students will probably not work towards limiting inequalities in the education system. Of course, all teachers have different experiences and methods even without digital tools being included, but perhaps educational IT creates even larger differences. If teachers embrace all the possibilities of educational IT and apply it to their teaching in appropriate ways, this thesis and previous research has shown that it can enhance learning opportunities (Öman & Svensson, 2015) and how learning activities are organized. On the other hand, teachers who are negative towards the digitalization movement might apply digital tools in their teaching as little as possible, not fostering students' digital competence or digital health.

As Selwyn (2019) declares, teachers need to identify problems and estimate how technologies can be utilized to address those problems. In some cases, technology might not be needed at all. The fact that students have constant access to tablets should not be reason enough to work with them at all times. As can be found in both this study (Excerpt 5.15), and the study by Kontkanen et al. (2016), some students found it nice to perform tasks that did not include the

tablet. However, viewing problem solving from a technological perspective is a good start in becoming more digital and utilizing digital tools in a better way, while it is also important to acknowledge that digital tools must not be the focal point of all lessons.

Another interesting point of discussion is opinions on the subject specific digital teaching material provided by Gleerups. While seventh-grade students were generally content with the software (Excerpt 3.1-3.5), ninth-graders were of different opinions (Excerpt 7.1-7.5). The fact that the interviews were conducted during lessons might cause students to have that specific subject's material in mind. A general opinion amongst people with connections to the material, both students, teachers and producers, is that social science has one of the best digital material (Excerpt 3.7). Hence, if seventh-grade students answered interview questions with the social science material in mind, and ninth-grade students with the English material in mind, it would be a probable cause for the big variations in opinions. Opinions will always differ, and the important matter does not seem to be whether the material is digital or not, but rather the content. Hence, it is difficult to draw any conclusions on the subject specific digital teaching material.

6.3 Digital tools for enhanced learning?

From findings in this study and from previous research, it is hard to find results that clearly demonstrate signs of enhanced learning when digital tools are utilized. One example of this is results from PISA showing that impact on learning outcomes when computers are used in the classroom is inconsiderable (Peña-López, 2015). The study by Sanders and George (2017) asserts that there is limited evidence of improved efficacy but Wang et al. (2015) show slightly enhanced language learning when tablets are utilized as a classroom tool at university level and Haerlmans (2017) find some aspect of enhanced learning. In the slightly older study by Kirschner, Martens and Strijbos (2004), researchers have a more visionary view of educational IT. They maintain that technology is a powerful, mediating tool that itself will improve teaching and learning. This expectation of educational IT seems rather unrealistic, and one should not expect enhanced learning simply based on new resources. Still, several possibilities are found in the digital classroom. Säljö (2010) instead suggests that technology indeed can change how learning happens, however one should not expect that IT itself will change learning or performance. As seen in this study, possibilities mostly focus around organizing learning. Previous research and observations show possibilities of organizing learning through having all material in the same place, not having to carry around books, individualizing learning, increasing creativity and enhancing collaboration. When these positive aspects outperform challenges, one could pose the question whether simpler organization of learning activities could be a satisfying outcome of introducing digital tools in the classroom.

6.3.1 Limitations and further research

The findings of this study are mostly parallel with findings from previous research. However, since it is a qualitative study with a limited sample, and as results differ between participating classes and teachers, I make no claims of generalizing the results to a wider population. A challenging task of this research was to find teachers willing to participate in the study. Clearly, more classrooms, teachers and students would have contributed to a better general view of the topic. However, due to the time allocated for work on this research, two teachers and three classes proved to be adequate. By drawing on previous research one could argue that this research contributes somewhat to the field of research.

Inevitably, this research was open for bias. There is a possibility of unintended bias due to translation, however interviews were transcribed and translated with the aim to be as accurate as possible. Both interviews and observations are unavoidably selective in terms of what, why, where, who, when and how the interviews and the observation take place (Cohen et al., 1993). Another challenge during interviews and observations were the students' attitude towards me as a researcher. It was apparent that some students were very comfortable being observed, while others considered it troublesome being inspected. Presumably, my presence influenced their behavior somewhat. To diminish this as much as possible my intention was to create a good atmosphere with students during the time at the school.

This research examines what possibilities and challenges exist in a classroom mediated by digital tools, and what aspects becomes significant structuring recourses for the students' work in the classroom activities. For future research, more observations and interviews in several different classrooms could contribute to the field with additional perspectives. Observing classrooms utilizing different resources, both tools and teaching material, would also be an interesting perspective.

7. Conclusion and implications

In line with previous research the findings of this study indicate that teachers have a significant role in implementing IT in the classroom, and that it is a challenging and time-consuming assignment. Several studies, as well as this one, return to the fact that the teachers are the main structuring resources in the classroom and invaluable for successful implementation of educational IT.

Despite research and commitment, many implementation challenges still remain. These challenges, or rather obstacles, include implementing digital tools into established teaching and learning practices, as well as arriving at successful outcomes. It is hard to find solid evidence of academic performance as a result of alone introducing digital tools, as seen in e.g. Haelermans (2017) and discussed by Säljö (2010). As more and more schools introduce digital devices and invest in digital teaching material, and as the government presents ambitious digitalization strategies, one may believe that IT itself will improve education. There are several factors influencing digital tools' positive impact, such as frequent interaction, student engagement and group participation. However, digital tools do not on their own seem to improve educational practices, as is apparent also in this master thesis. Even so, the discussion about productive pedagogies and educational practices often takes place under the premises that current technologies have been introduced.

Hence, the issues of implementing IT in education cannot be reduced to educational institutions being slow integrators of the technology. Rather, these institutions have been around for a long time, possessing adequate knowledge of properly valuing teaching material of various kinds. Säljö (2010) argues that "the technology does not facilitate or improve learning in a linear sense, rather it is currently changing our interpretations of what learning is and changing our expectations about what it means to know something" (p. 56). Technology is challenging the traditions of teaching and learning, hence making it complex to implement in educational practices. Technology also contributes to transforming the concepts of what learning is and metaphors of learning on which pedagogy and instruction have been based.

The findings from this thesis may be relevant in the work of teachers, heads of education, and digital learning material developers. It is important that students and teachers know how to utilize digital tools and exercise them in appropriate ways. By developing knowledge of educational IT, stakeholders can recognize how the possibilities of digital tools can become more realistic in classroom activities.

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Appendix A – Interview framework

Interviews with students

How do you use digital tools in the classroom?
What resources do you usually use? Apps, tools…
What do you think about digital tools in the classroom?
What kinds of possibilities are there that you could not do without digital tools?
What kinds of challenges or problems arise in a digital classroom? When do these challenges arise?

How do you work with your tablets? Taking notes, cooperation, creativity.
Do you often get distracted while working with digital tools in the classroom?
What do you think about bringing the mobile phone to the classroom?

How do you look at the teacher's role when you are using digital tools in the classroom?

What do you think about the subject specific digital teaching material (Gleerups)?
How do you use it?
What are some good and bad things? What could be better?

Interviews with teachers

How do you use digital tools in the classroom?
What tools do you usually use? Apps, devices…
Why do you use digital tools? What works well and what possibilities arise?
What kinds of challenges or problems arise with digital tools in the classroom? When do these challenges arise?
How do you think students' possibilities of adapting their learning is affected with digital tools?

What is your opinion about tablets? How do you and your students work with them?
Do the students often do other things on their tablets than what you tell them to do?

What do you think about students bringing their mobile phones to the classroom?

Is anything in your role as a teacher changed when digital tools are introduced?
How is your pedagogy affected by digital tools?

What do you think about the subject specific digital teaching material (Gleerups)?
How do you and your students use it?
What are some good and bad things? What could be better?

Appendix B – Observation framework

What digital tools are used in the classroom?
What digital hardware is accessible in the classroom?
What is enabled by digital tools that would not have been possible without it?
What difficulties arise with the digital tools?
What other learning material is utilized? Handouts, physical books etc.

Behaviors (what are the teacher and the students doing)?
Emotions? Positive/negative?

What types of interactions happen in the classroom? Student-student and teacher-student?
How do they relate to each other?
Are there distractions from the digital devices?
Flow of the lesson, interruptions from technical problems?
What is the role of the teacher? Facilitator, source of information, in the background?

How is the subject specific digital teaching material (Gleerups) used? Is it used?

Appendix C – Consent forms

Students

INSTITUTIONEN FÖR PEDAGOGIK, KOMMUNIKATION OCH LÄRANDE

GÖTEBORGS UNIVERSITET

Till dig som är elev på ███████████

Medgivande till din medverkan i en forskningsstudie om hur digitala resurser används i klassrummet och vad det innebär för klassrummets dynamik.

Under denna termin kommer jag, Sofia Hedén, genomföra studier till grund för min masteruppsats i samarbete med Gleerups på ███████████. För detta behövs lärares, samt föräldrars eller vårdnadshavares medgivande. Uppsatsen skrivs under sista terminen av mastersprogrammet i IT och Lärande vid Göteborgs Universitet.

Kort presentation av projektet
Uppsatsen avser undersöka hur digitala resurser används i klassrummet och vad det innebär för dynamiken i klassrummet. Studien är ett samarbete med Gleerups, som tillhandahåller de digitala läromedel som används på skolan. Frågeställningar som kommer att undersökas är hur interaktionen med digitala resurser ser ut, och vilka utmaningar och möjligheter det för med sig. Ytterligare en synvinkel som kommer att undersökas är vad det innebär för dynamiken i klassrummet när digitala läromedel introduceras i relation till traditionella/analoga läromedel.

Studien kommer baseras på klassrumsobservationer, enskilda intervjuer och gruppintervjuer genom audioinspelning. Jag vill tydliggöra att *enskilda elever och deras kunskap inte kommer att vara av intresse*, *inte heller enskilda lärares arbetssätt,* utan fokus kommer att ligga på att skapa en helhetsbild av interaktionen med digitala resurser. I masteruppsatsen kommer skolan att anonymiseras och elever och lärares riktiga namn kommer inte att nämnas i uppsatsen. Istället kommer fiktiva namn användas. Allt arbete kommer att ske i enlighet med GDPR[8].

Elever som inte ger medgivande till att medverka i studien kommer självklart att kunna delta i klassrummet och undervisningen som vanligt, men kommer ej vara delaktiga i intervjuer eller observationer.

Kontakta gärna mig eller min handledare vid frågor och funderingar!
Sofia Hedén, masterstudent

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[8] https://www.gu.se/omwebbplatsen/behandling-av-personuppgifter

GÖTEBORGS
UNIVERSITET

Sida 2(2)

Underskrift av elev

Eftersom denna typ av datainsamling kräver elevens medgivande önskas att du meddelar i talongen nedan om du vill delta i projektet. Medverkan är högst frivillig och du kan när som helst välja att avbryta medverkan.

Talongen lämnas in till ansvarig lärare på ▌▌▌▌▌ snarats

Medgivande till elevens medverkan i en forskningsstudie om hur digitala resurser används i klassrummet och vad det innebär för klassrummets dynamik.

☐ Ja, jag vill delta i studien. Datan får användas i forskningssammanhang.

Datum:_____

Elevens namn:_____

Elevens underskrift:_____

Klass:_____

GÖTEBORGS UNIVERSITET

Teachers

INSTITUTIONEN FÖR PEDAGOGIK, KOMMUNIKATION OCH LÄRANDE

Till dig som är lärare på ▮▮▮▮▮▮

Medgivande till medverkan i en forskningsstudie om hur digitala resurser används i klassrummet och vad det innebär för klassrummets dynamik.

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Vårdnadshavare eller elever som inte ger medgivande till att medverka i studien kommer självklart att kunna delta i klassrummet och undervisningen som vanligt, men kommer ej vara delaktiga i intervjuer eller observationer.

Kontakta gärna mig eller min handledare vid frågor och funderingar!
Sofia Hedén, masterstudent

Annika Lantz-Andersson, universitetslektor

INSTITUTIONEN FÖR PEDAGOGIK, KOMMUNIKATION OCH LÄRANDE

Underskrift av lärare

Eftersom denna typ av datainsamling kräver lärarens medgivande önskas att du meddelar i talongen nedan om du vill delta i projektet. Medverkan är högst frivillig och du kan när som helst välja att avbryta medverkan.

Medgivande till medverkan i en forskningsstudie om hur digitala resurser används i klassrummet och vad det innebär för klassrummets dynamik.

☐ Ja, jag vill delta i studien. Datan får användas i forskningssammanhang.

Datum:_____

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[9] https://www.gu.se/omwebbplatsen/behandling-av-personuppgifter

Namn:_____

Underskrift:_____

Guardians

INSTITUTIONEN FÖR PEDAGOGIK, KOMMUNIKATION OCH LÄRANDE

Till dig som är vårdnadshavare till en elev på ▮▮▮▮▮▮▮▮

Medgivande till elevens medverkan i en forskningsstudie om hur digitala resurser används i klassrummet och vad det innebär för klassrummets dynamik.

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Kort presentation av projektet

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Kontakta gärna mig eller min handledare vid frågor och funderingar!
Sofia Hedén, masterstudent

Annika Lantz-Andersson, universitetslektor
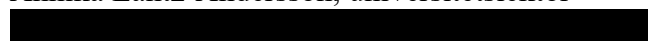
INSTITUTIONEN FÖR PEDAGOGIK, KOMMUNIKATION OCH LÄRANDE

Underskrift av vårdnadshavare

Eftersom denna typ av datainsamling kräver vårdnadshavares medgivande önskas att vårdnadshavare meddelar i talongen nedan om ert barn får delta i projektet. Medverkan är högst frivillig och elevens och dess vårdnadshavare kan när som helst välja att avbryta

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[10] https://www.gu.se/omwebbplatsen/behandling-av-personuppgifter

medverkan. Om eleven själv inte vill delta i studien kommer hen naturligtvis inte behöva göra det.

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Medgivande till elevens medverkan i en forskningsstudie om hur digitala resurser används i klassrummet och vad det innebär för klassrummets dynamik.

☐   Ja, jag ger tillstånd att mitt barn deltar i studien. Datan får användas i forskningssammanhang.

Datum:_____

Elevens namn:_____

Klass:_____

Målsmans underskrift:_____

Målsmans namn:_____

* Målsmans underskrift:_____

Målsmans namn:_____

*Vid delad vårdnad behövs båda vårdnadshavares medgivande

Information letter

INSTITUTIONEN FÖR PEDAGOGIK, KOMMUNIKATION OCH LÄRANDE

Informationsbrev om en forskningsstudie under VT19 om hur digitala resurser används i klassrummet och vad det innebär för klassrummets dynamik

Under denna termin kommer jag, Sofia Hedén, genomföra studier till grund för min masteruppsats i samarbete med Gleerups på ████████. För detta behövs lärares, samt föräldrars eller vårdnadshavares medgivande. Uppsatsen skrivs under sista terminen av mastersprogrammet i IT och Lärande vid Göteborgs Universitet.

Detta informationsblad riktas till dig med en elev som fyllt 15 år och som anses vara kapabel att själv ta ställning till frågan. Endast de elever som skriftligen medgivit att de vill deltaga kommer att vara med i studien.

Kort presentation av projektet

Uppsatsen avser undersöka hur digitala resurser används i klassrummet och vad det innebär för dynamiken i klassrummet. Studien är ett samarbete med Gleerups, som tillhandahåller de digitala läromedel som används på skolan. Frågeställningar som kommer att undersökas är hur interaktionen med digitala resurser ser ut, och vilka utmaningar och möjligheter det för med sig. Ytterligare en synvinkel som kommer att undersökas är vad det innebär för dynamiken i klassrummet när digitala läromedel introduceras i relation till traditionella/analoga läromedel.

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Kontakta gärna mig eller min handledare vid frågor och funderingar!
Sofia Hedén, masterstudent
████████████████████

Annika Lantz-Andersson, universitetslektor
███████████████████████

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[11] https://www.gu.se/omwebbplatsen/behandling-av-personuppgifter