Barriers of Digital Technologies in Higher Education
A Teachers’ Perspective from a Swedish University
Abstract

Digital Technologies are gaining more and more importance in higher education as they not only reshape and digitalize the on-campus teacher-student communication but also – in times of globalization – open up education to the world. It further facilitates individuals who would have been otherwise excluded from education to attend distance education programs. Such possibilities of digital technologies depict new opportunities for universities and enables them to emerge into a whole new market. Apart from all these benefits, the permeation of digital technologies in higher education brings along challenges and barriers for the teachers.

Consequently, the purpose of this study is to identify the digital technologies that teachers are using to fulfill their daily teaching activities and to investigate the prevalent attitude of teachers towards digital technologies in higher education. It further identifies the barriers that arise with the adaption of the respective technologies and examines the strategies which teachers developed to deal with these barriers.

For this purpose, the qualitative study follows the interpretive paradigm and adopts semi-structured interviews and a focus group in a young medium sized Swedish University. After coding, categorizing and conceptualizing the findings, the study shows that teachers have an overall positive attitude towards digital technologies but also experience negative emotions when encountering barriers. The identified barriers range from cognitive limitations of teachers, to technological downsides, to issues concerning the support over to institutional constraints. The findings furthermore show that the attitudes, barriers, and strategies to circumvent the barriers are intertwined with and have impacts on each other.

Keywords
digital technologies, higher education, teaching, barriers, attitude, strategies, teacher
List of Abbreviations

ICT  information and communication technology
LMS  learning management system
Lnu  Linnaeus University

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1 Introduction

“Communication is hard, yet it is the most fundamental thing we do as human beings.”

- (Slack, 2016)

The idea of using digital technologies for education is not a completely new approach. Koubek and Jandl (2000) for example refer to a center that is concerned about the use of digital technologies which was founded already in 1998. Mazzarol, Norman Soutar and Sim Yaw Seng (2003) discuss the shift from universities that are physically engaging international markets towards the use of digital technologies in order to bring their product, namely education, to the customer in distance. With referencing to Bartlett (1997), identifying that there have been several study programs available already in 1997 which were offered online, referring to them as a wired classroom.

Since the end of the 20th century, according to John (2015, p.232), especially digital technologies in education have experienced huge developments. These developments were accompanied with huge investments in the technologies (John, 2015, p.232). Now, 20 years later, digital technologies became a crucial part in the education. According to Talebian, Mohammadi and Rezvanfar (2014) digital technologies gained major importance for the prevalent education in the 21st century and have permeated the educational environment. They did not only become the mainstream way to educate but also transformed the speed and the way how knowledge is nowadays transferred between teachers and students (Talebian, Mohammadi and Rezvanfar, 2014).

Over the years of development there have many other terms around the digital technology use in education and respective pedagogical approaches emerged. These terms have by now replaced the initial terminology of a wired classroom as Bartlett termed it in 1997. This variety of terms and concepts for digital technologies in education and the lack of a compliant view to dissociate them is existent due to their intertwined nature.

As an example, two of these newer terms are blended learning or hybrid teaching, which refer to the combination of face-to-face education and online education (Porter et al., 2016; Garrison and Kanuka, 2004, p.96). Garrison and Kanuka (2004, p.99) stress that blended learning is not just simply about combining two concepts but to redefine the strategies and paraphrases Marshall McLuhan with the words:

„it is not enough to deliver old content in a new medium“

As another example of term variety, the concept of the flipped classroom has emerged in the last years from the primary and secondary education and made its way to higher education (O’Flaherty and Phillips, 2015). The usual lecture is being removed from the classroom and the physical meeting is instead being used to provide room for discussions and collaborative learning (Tucker, 2012). The mediation of knowledge in the form of i.e. lectures is now being replaced by alternative media such as videos or interactive lessons (Tucker, 2012). Instead of mediating this knowledge in the classroom, the students work with the material prior to the classroom meeting from home (Tucker, 2012).

With already these three terms (blended learning, hybrid teaching and flipped classroom) only two concepts are being described. These two concepts just being examples of the diversity of terminology and concepts. For simplicity, the study will mainly make use of the in the Introduction defined general term digital technology. For
the sake of convenience and to reduce confusion among the terms this study will limit the classification of digital technologies into distance education and e-learning. Distance education is hereby seen as technologically enhanced teaching that is performed over distance with an absence of physical meetings, whereas e-learning will be understood as technology enhanced teaching while holding on to physical meetings on campus.

It can be observed that digital technologies are used in many different ways in education; inside the classroom, outside the classroom, for learning purposes, administrative purposes or communication purposes. Digital technologies for education purposes such as learning management systems (LMS), blogs, wikis or instant messengers are gaining more and more importance on- and off-campus to utilize an easy and fast exchange of information (Ketterl, Mertens and Vornberger, 2009, p.2).

This study is going to examine the domain of digital technologies use in higher education, whereas digital technologies are here being understood as modern technologies enhancing and supporting the educational practices of teachers on a day-to-day basis.

However, there is not one definite definition of the concept of digital technologies. To start with developing a definition for this concept, a first look at the term technology will be taken. It can be said that a clear border of what can be considered as technology and what not cannot be easily drawn. According to Bates (2015, p.186) we are surrounded by technologies and components such as hardware, software, networks and services which all play a role in the domain of technologies. Those can range from traditional technologies (e.g. overhead projectors) to modern technologies (e.g. video conferencing systems).

Also the immersion of technologies in the educational sector is not clearly defined and is described by scholars with a variety of terms such as information and communication technology (ICT), educational technology or digital technology. The terms are often used interchangeably and a lack of clear distinction is apparent. As an example for this ambiguity, some scholars make use of the term educational technology in their research (e.g. Moore and Ellsworth, 2014; Bates, 2015; Englund, Olofsson and Price, 2017), while a more commonly used terms is ICT. The term ICT is for example used by the European commission for future plans to extend the digitalization of the education in schools and universities (European Commission, 2013; Tribukait et al., 2017; European Commission, 2012) and by scholars such as Richard (2015) who takes a glance at the role of ICT in higher education.

On the other hand, the term digital technologies is utilized by Eriksmo and Sundberg (2016) in order to reflect upon the use of technologies in higher education. Also Laurillard et al. (2016) recently used the term to address the need of professors to adapt to the changing nature of education. A few more years back, Mishra and Koehler (2008, pp.3–4) refer to digital technologies as advanced technologies such as web browsers, e-mail programs and the internet as such, while they differentiate the digital technologies to so called standard technologies like books, chalk- and blackboards.

On the basis of these examples it can be seen that there is no common ground among research. Therefore, this study will build upon the concept of digital technologies, whereas digital technologies are understood as all the modern technologies and systems
that are used for interaction, information and communication purposes as well as administrative duties in the educational context. The study mainly focuses on the software systems, such as learning management systems, video conferencing systems or schedule administration systems. As hardware such as computers, laptops, microphones or cameras are directly linked to the use of these systems, such hardware devices will not be completely ignored in the study but will not take any predominant role. The above mentioned standard technologies (e.g. blackboards) will be referred to as traditional technologies throughout the thesis.

1.1 Motivation

The initial interest to study the domain of digital technology use in higher education originates from my own experiences throughout my studies. Digital technologies that teachers used in the educational setting of my universities turned out to be experienced in several occasions as troublesome. These personal experiences consisted of technological downsides (e.g. connectivity problems in video conferences) or my personal perception that some teachers were not thoroughly aware of how to utilize the technologies such as their computer or the projector in the classroom. Furthermore, during my studies in Germany I have observed that some departments used own systems to provide study material for the students instead of using the imposed technology by the university (the central learning management system). My interpretation is that this was justified due to their lack of acceptance of the digital technologies.

These personal experiences motivate me to further investigate the digital technologies used by teachers in higher education at the Linnaeus University (Lnu) and identify problems and challenges that occur from the perspective of the teachers. Contiguous to my experiences, which are solely based on my perception, there are also plenty of scholars who have investigated the use of digital technologies in education and lay the foundation for this study.

To start with, several studies indicate that the use of technologies have a positive impact on education. Venkatesh et al. (2014) for example refers to the increased motivation of students and the better course effectiveness. Also, higher education institutions are becoming more and more interested in more sophisticated technologies and tools (Venkatesh, Croteau and Rabah, 2014) and efforts to restructure educational practices are taken (Shanmugam, Srinivas and Reddy, 2014). This includes also that teachers need to be trained and have to have the know-how in the prevalent technologies (Shanmugam, Srinivas and Reddy, 2014).

It was eye-catching that a plethora of studies deal with the digital technologies in education in relation to students. The students perspectives and perceptions are extensively covered (e.g. Mohammadi, 2015; Venkatesh, Croteau and Rabah, 2014; Zainuddin, Idrus and Jamal, 2016; Selwyn, 2016; Ellis and Goodyear, 2013) while other scholars examine the effects of learning with digital technologies on the students achievements (e.g. Al-Qahtani and Higgins, 2013). Also Islam, Beer and Slack (2015, p.102) point out that the majority of the research concerning digital technology use in education examines primarily the perspective of the students.

Furthermore, the research about digital technologies and their incorporation into teaching has prioritized the needs and developments of students rather than including the teacher perspective (Bennett, 2014, p.1). Consequently, this review of the literature
shows that the amount of research that has the focus on the teachers is relatively limited. Therefore, this study is going to focus on the in research underrepresented perspective of teachers.

A general tendency that teachers are willing and motivated to use digital technologies in their education is identified by Bennett (2014). She states that teachers pursue the pedagogical goal to improve their teaching practices with technology. Also other scholars accredit teachers general positive attitude towards digital technologies. For example, Greener and Wakefield (2015) deal with the enthusiasm teachers share with the use of mobile technologies in teaching but also identifies a lack of confidence with technologies and a lack of pedagogical knowledge of how to integrate those technologies into teaching. However, in the examination of the relationship between the pedagogical belief of teachers and the use of digital technologies, Tondeur et al. (2017) come to the conclusion that these beliefs also can prevent the integration of technologies. This decision is depending on the beliefs of what is perceived as ‘good teaching’ and they argue that some teachers will tend to stick to traditional technologies when the traditional practices are perceived as still working.

Besides the couple of research concerning the attitudes, e.g. Islam, Beer and Slack (2015) identify technological challenges from the teacher perspective such as bugs, low speed or missing features and state that these aspects can easily lead to a failure of the e-learning system. They further identify a lack of training for teachers in order to operate digital technologies respectable.

Partially, the motivation to focus on the teacher perspective rather than the students perspective is based on the minor coverage in research. On the other hand, my motivation to set teachers into the focus of this study is based on my belief that they have a better insight in digital technologies use and processes that are followed. My belief is that this enables me to better identify where the problems are. This is based onto the findings by Suchman (1995) who points out that a major part of work is not visible and best known by the actors executing the work. Neither are outsiders nor differently positioned actors inside the organization fully aware of the colleagues work details. She furthermore states that assumptions are made too often rather than identifying the real work practices (Suchman, 1995, p.56). This strengthens further my motivation to adapt an approach focused on teachers perspective rather than students perspectives.
1.2 Purpose and Research Question

The purpose of the study is to identify the digital technologies that teachers are using to fulfill their daily teaching activities and to investigate the problems that arise with the use of these technologies. The focus of this study lies on the barriers and attitudes of teachers towards digital technologies and the aim is to detect “solution” strategies that the teaching staff adapts to fulfill their teaching responsibilities despite technological issues.

To gain a better understanding of how the teachers perceive their use of the digital technologies, what challenges they encounter and how they deal with them, the following three research questions have been defined:

1) What attitude do teachers have towards the regular use of digital technologies in education?
2) What are the barriers teachers face with the use of the digital technologies?
3) How do teachers deal with these barriers?

1.3 Scope and Limitations

As my inspiration to this study is founded on a specific experience I observed during my studies at the Linnaeus University on Campus Växjö, my interest arose to examine the problems that teachers encounter in their daily job and with their daily activities. The data collected is therefore limited to the experiences of the teachers on campus Växjö at Linnaeus University and is complemented with views from an educational technologist and an e-learning specialist. Students are deliberately excluded from this study. Based on this, the study only examines the use of digital technologies in higher education. As stated, the majority of the collected data will represent the perspective of the teachers.

Even though the focus is set on typical digital technologies (such as learning management systems, video conferencing software, etc.) in the education sector, it is important to note that the intention is not to limit the study to those, but also keep the study open to less prominent kinds of digital technologies that are not officially established tools from the university but that teachers use anyway for their daily practices in education.

As there is a plethora of different digital technologies used, the study is limited to the digital technologies that I am aware of, as well as to those which are brought up by the interviewees and focus group participants on their own. The scope of the study is therefore not only limited to the officially imposed technologies by the university, but also considers technologies that teachers decided to use.

Another limitation of this study is the focus on the educational tasks teachers pursue. These may contain holding lectures, seminars or communicating with students. Tasks that are accompanied with the teacher’s research or other administrative work (such as their wage accounting) is not taken into account by this study. As the teaching as such comes along with administrative duties, I am well aware that some administrative issues that are related to the teaching task will play a role in my data collection.
1.4 Thesis Disposition

The structure of the thesis is organized into a total of the following five chapters as it is illustrated in Figure 1-1:

![Diagram of thesis disposition]

**Figure 1-1. Thesis Disposition**

*Literature review:*
This chapter provides an overview and reviews the existing literature. It gives background information and definitions on the most common concepts used in research that are related to the topic of the study and relates the study to previous relevant research.

*Research Methodology:*
The next chapter covers the research methodology and presents the applied research strategy and the setting of the research. It further discusses the data collection methods and analysis method. Eventually the chapter discusses criteria for the validity and reliability and ethical considerations of the research.

*Empirical findings and Analysis:*
The collected data lays the foundation for the in this chapter presented empirical findings. The findings are based on and structured according to the concepts that emerged from the analysis of the raw data. Furthermore the analysis of the data will be presented here.

*Discussions:*
This chapter discusses the results of this study in relation to prior research identified in the literature review. It establishes relations between the findings and discusses the dependencies among them. Further, this chapter will provide suggestions for future research.

*Conclusions:*
The last part the study reaches to the conclusions and contribution of the study and elaborates own reflections.
2 Literature Review

The following chapter starts with an overview of the history of education, the accompanied use of technologies and gives insights into the changing nature of terminologies for these technologies. It then elaborates on the development of distance education in higher education. Following, the concepts of e-learning and distance education are dissociated from another before the role of digital technologies in higher education is discussed. The literature review continues by viewing at related studies concerning technology beliefs, attitudes of teachers and barriers in education. The chapter finalizes with a short conclusion of the literature review.

The research field of digital technologies in education has its roots in many different disciplines like education, computer science, psychology, cognitive science, communications technology, and educational technology and there exists disagreement amongst researchers whether or not the research field has developed already into a discipline on its own (Ren, 2014, pp.ix–x).

2.1 History of Education, Technology and Terminologies

Learning how things in the world work lies in the nature of the human kind and has been present ever since. Various indicators of the transfer of knowledge, according to Bates (2015, pp.189–191), go as far back as to the fifth century B.C in the form of written documents whereas the prior knowledge transfer was pursued solely by oral communication. Subsequently, the use of slate boards can be dated back until the 12th century and were used in India before then blackboards got introduced in western schools in the 18th century. Meanwhile, the development of the printing press in the 15th century enabled also the masses to access knowledge.

Further development has continued throughout the years and with the time that different technologies supported the education more, also research concepts, such as the instructional technology, formed. According to Reiser (2013, p.11) there are, amongst others, two major definitions of this concept. One definition describes instructional technologies as the process of designing, carrying out and evaluating instructions for the educational purpose.

The other one is focusing on the technologies that are used in addition to the traditional materials (e.g. textbooks or blackboards) such as TVs, films, overhead projectors, computers or other types of either hardware or software. Major impact on the instructional technologies are attributed to audiovisual devices to which the above mentioned are counted to. The notion to supplement pure written content with audiovisual content to enhance learning can be traced back to more than 400 years ago (Reiser, 2013, pp.12–13). Over the centuries more efforts were made in regards to improve the audiovisual content for education purposes until the second world war broke out. While the progress slowed down in traditional education, a lot of development and improvement was made for military purposes. As the training of soldiers proved to be effective, development for the military continued afterwards. Bates (2015, p.190) underlines that the development of these technologies were not driven by the purpose to apply them in the traditional education setting but rather in the military and in businesses.
Besides technologies that found use, for instance to play back film- or audio recordings, the production of overhead projectors started during the war and experienced a notable use in the military (Reiser, 2013, p.15). The overhead projectors can be seen as exemplary for the pervasion of military technologies in the subsequent education in, for instance, schools and higher education. Overhead projectors can be still seen more than 70 years later today in classrooms. Although the trend seems to move towards an extinction of this kind of technology.

Also, the nowadays widely used delivery of lectures via web conferencing technologies can be seen as a remainder of the former military arming efforts (Bates, 2015, p.190). After many centuries of advancement and development of the instructional technology concept, a new and major definition change of the field has been released and the term educational technology was born (Reiser, 2013, pp.19–20).

The use of the two terms have changed since then several times due to further attempts to redefine the field, which lead according to Lowenthal and Wilson (2010, p.39) to an interchangeable use of the terms. The latest recurring redefinition of the field in 2008 has lead (again) to the term educational technology, which garnered criticism from Lowenthal and Wilson (2010). They criticize the insufficient involvement of stakeholders and reasoning behind the change and furthermore argue for the importance of a good label for the field. While first experiences were gathered with computers in the postwar period, educational efforts gained ground from the late 1970s and onwards. For the concept of presenting education material with computer technologies the term computer-assisted instruction was coined (Reiser, 2013, pp.38–40).

These past developments illustrate that a lacking unity prevails in the field of educational research which also adds another layer of complexity and confusion to the field. In the past years, many different terms have been added to the pool of nomenclatures to describe the same, similar or related concepts, such as distance learning, distributed learning, e-learning, blended learning or the flipped classroom. In agreement to this, Guri-Rosenblit (2006, p.156) identifies the lack of standardization in the field and compiles the following (incomplete) list of 15 different terms used among scholars to define technology enhanced education: web-based learning, computer-mediated instruction, virtual classrooms, on-line education, e-learning, e-education, computer-driven interactive communication, open and distance learning, I-Campus, borderless education, cyberspace learning environments, distributed learning, flexible learning, blended learning and mobile-learning.

This complexity makes it hard to keep the terms, concepts and their definitions apart from each other. Therefore, this study will orientate itself on the two major concepts, of distance education and e-learning.

As stated in the Introduction, distance education is hereby seen as technologically enhanced teaching that is performed over distance with an absence of physical meetings, whereas e-learning will be understood as technology enhanced teaching while holding on to physical meetings on campus.
2.2 Development of Distance Education in Higher Education

After having given a more general overview over the general developments of how technologies have entered the educational settings, a closer look at the history of distance education will be given.

As discussed beforehand, a clear distinction between the different concepts is hard to define. Distance education possessed to some extent a pioneer role to the technology use in education. This was due to the desire to improve distance education and to increase flexibility. According to Anderson (2008, p.53), distance education can be seen as a superset of e-learning and other related concepts. Distance education can be therefore seen as an important part that has shaped and influenced all of todays technological enhanced education. Therefore, we will begin by having a look on the history of distance education.

Distance education is by no means a concept that has just evolved with the digital age and can be dated way further back. First evidence of distance education can be attributed to around the middle of the 19th century, when first post correspondence for educational purposes was advertised. According to Simonson et al. (2014, p.36), first appearances of some sort of education services via postal services go back for example to Sweden (advertisement of a distance study opportunity in a newspaper in 1833) or to England (distribution of shorthand instructions via a new postal service). This early form of distance education is refered to as correspondence study which has its origin in the education of language in Germany (Simonson, Smaldino and Zvacek, 2014, p.36). Over the years, the concept of correspondence study grew more and more as also universities picked up this concept and offered it to distance students to obtain a degree. Simonson et al. (2014, pp.36–38) present various universities and colleges that enabled or established new departments or institutions to offer this correspondence study, such as the Chautauqua College of Liberal Arts in New York, the International Correspondence School in Pennsylvania or the Skerry’s College in Edinburgh, just to name a few.

To loosen the placement of the developments in distance education in history up, and not going through them gradually on the timeline, the presentation of further developments in distance education are arranged according to the classification by Anderson and Dron (2011). They group the developments of distance education systems from a pedagogical perspective into three distinct eras. Based on the idea that teachers are pedagogically driven, they create this classification as an alternative to the technology driven framework by Taylor (2001), which has a total of five generations and reduce it to three so called eras. As they see the pedagogy and the technology as being “intertwined in a dance: the technology sets the beat and creates the music, while the pedagogy defines the moves”, their eras differentiate themselves i.e. through their pedagogical approaches or their use of technologies (Anderson and Dron, 2011, pp.80–81). The development of the pedagogies advanced with the availability of more enhanced and capable technologies (Anderson and Dron, 2011, p.91).

The first era – the cognitive and behaviorist pedagogy – perceives students as individual learners and provides them with linear instructions through technologies by for example distributing material via postal services, television programs, or holding telephone conferences (Anderson and Dron, 2011, pp.82–83). As introduced above, first efforts with e.g. postal services were already made in the 19th century and first moves towards television that mediated education were made in the 1930s but not officially
offered until the 1950s (Simonson, Smaldino and Zvacek, 2014, p.38). Further developments in the upcoming years lead to a more widespread use of these distance education technologies and eventually the pedagogical field for the first era formed. This era depicted the first way of distance education in the second half of the 20th century and enabled more students to gain access to education but also lacked interactivity on a social and cognitive level (Anderson and Dron, 2011, pp.83–84).

The second era – the social-constructivist pedagogy – evolved to a generation that emphasizes the reciprocal communication and therefore enhanced interaction between students and teachers (Anderson and Dron, 2011, p.84). It is based on the philosophy that knowledge creation is “in the minds of individual learners” and that relationships and contexts play an important part in this process (Anderson and Dron, 2011, pp.84–85). Holmberg (2005, p.24) state that this individual learning causes students to gain different knowledge in the same course due to their own interaction and sense making of the course subject.

Pioneer technologies in this era was for example the e-mail which then got complemented through application of the internet and mobile technologies (Anderson and Dron, 2011, p.85). As commonly known, the internet is then another technology that has its origin in developments for the military, which found its way eventually to be applied in education just as the overhead projector. Simonson et al. (2014, p.39) attribute the use of the internet for education since the mid-1980s. It further can be said that the development of the internet and the associated use of computer-mediated communications had a tremendous impact on the growth of distance education (Simonson, Smaldino and Zvacek, 2014, p.39). This importance of the internet of distance education and education in general is clearly reflected in its ubiquitous use nowadays, which will become apparent in the third era.

The third and current era – the connectivist pedagogy – moves from an distance education environment which is based on groups towards one that is facilitated by the students’ networks consisting of personal contacts, information and resources (Anderson and Dron, 2011, p.87). The role of teachers has changed to the prior era as their education consists more of collaborating with the students than just providing the study materials and instructions (Anderson and Dron, 2011, p.88). The connectivist pedagogy is on one hand rich in interaction and on the other weak in providing a clear structure due to constant changes in the learning environment (Anderson and Dron, 2011, p.89).

Just as interaction between teacher and student is seen as a key component (Bates, 2015, p.198), interaction plays also a considerable role in distance education (Anderson, 2008, p.55). As interaction in the previous eras was limited to older technologies such as the postal service, the telephone or the fax machine, the internet has changed the nature of interaction considerably. The internet and other modern technologies enable us to have computer mediated conferences among students and teachers, which Simonson et al. (2014, p.39) depict as a difficult challenge with traditional technologies. Reasons for these difficulties can be for instance the slow pace of the messages exchange by using postal services. However, concluding it can be said that fundamental for the success of distance education has been the capability of the internet to easily communicate. In reference to this, Kirkup and Kirkwood (2005, p.3) refer to the internet as „an important driver for change“. 
The technologies of this era are based, according to Anderson and Dron (2011, p.92), on the Web 2.0. A major improvement of Web 2.0 is that everybody, like teachers and students, are able to consume as well as produce content whereas previously only a minority of users was able to produce content. In the educational settings, this can mean that students are able to e.g. publish their summaries and reports, or have subject related discussions in learning management systems.

However, this era is also met with criticism as teachers struggle to keep up with the amount of digital technologies and their fast advancements (Anderson and Dron, 2011, p.89). This means that they got to learn how to use the technologies that are already in place, learning new technologies that are introduced throughout their career, as well as keeping track of changes through updates and new versions. Students however also struggle in the connectivist pedagogy with the absent of comprehensive guidelines, and are bothered by getting used to the variety of digital technologies (Anderson and Dron, 2011, p.89).

2.3 Dissociation of E-Learning and Distance Education

As previous chapter has shown, the development of digital technologies in higher education has been driven by the demand for distance learning opportunities. However, the use of digital technologies in education at Lnu is not limited to distance education. Instead, there is also a lot of technology-mediated education on campus. Therefore, a dissociation of the digital technology use in face-to-face education, namely e-learning, to distance education will be subsequently drawn.

According Liu and Wang (2009, p.193) the e-learning concepts have their origin from (amongst others) Nonaka and Takeuchi (1995). Liu and Wang do not concretize this statement but several scholars that are exploring the field of e-learning refer to the research of Nonaka and Takeuchi on knowledge creation in organizations. Thus, knowledge creation is an important concept for e-learning and it can be concluded that the research by Nonaka and Takeuchi had influence on the development of e-learning. As an example, Nonaka and Takeuchi’s understanding of knowledge creation (that the conversion and interaction of explicit and tacit knowledge creates knowledge) is relevant for the research by Chatti, Jarke and Frosch-Wilke (2007, p.406) on e-learning. On another note, Lin (2010, p.249) sees the relationship between the learning process and service innovation process as an essential part in the innovation process of e-learning, a relationship identified by Nonaka and Takeuchi.

As stated in the introduction, a variety of terms is used in research, and so is there no prevalent used definition for e-learning and no distinction to other commonly used terms by scholars, such as distributed learning and distance learning (Arkorful and Abaidoo, 2015, pp.29–31; Oblinger and Hawkins, 2005, p.14). In 2001, Bates (2001, pp.19–23) breaks down the main ways how e-learning is used in higher education into the following three concepts:
- technology-enhanced classroom teaching,
- distance education,
- and distributed learning.

Other scholars follow similar categorizations and break e-learning down into distributed learning and online distance education (Maltz, DeBlois and Educause Current Issues Committee, 2005, p.24), or state that concepts such as web-based learning, advanced distributed learning or online-learning are synonyms to e-learning (Khan, 2001 cited in

In the technology-enhanced classroom teaching, digital technologies take over the functionalities of older technologies and relocate them, for example, from the classroom to a web-based virtual classroom (Bates, 2001, p.19). Instead of providing a printed lecture script, the teacher is able to upload the script or lecture slides to the virtual classroom. A virtual classroom can be realized for instance by using a learning management system.

With distributed learning, traditional teaching practices, such as face-to-face lectures, get reduced and replaced by digital technologies. Both education practices, by the use of digital technologies and the traditional face-to-face teaching, are mixed with each other and serve as a kind of hybrid form of teaching. As Collis and Wend (2002, p.64) state, the concept of distributed learning can be put on a level with the concept of blended learning. In research, blended learning is described as the attempt to combine the traditional approach of face-to-face teaching and the use of virtual teaching technologies. It is argued that face-to-face teaching incorporates the positive characteristic of live and instant interaction between teacher and student while virtual teaching (equally positive) disconnects the teaching experience from its bonds to time and place (Garrison and Kanuka, 2004, p.96).

In his most recent work, Bates (2015) defines these concepts similarly, but narrows them down to only two concepts with use of digital technologies. For what has been called distance education beforehand, he now uses the term fully online learning and refers to it as pure distance education without physical interaction. He further changed terminology from using distributed learning to the umbrella term blended learning, which comprises the concepts of technology-enhanced learning and other concepts that resemble distributed learning (e.g. hybrid learning, flipped classroom). As it can be seen, there are a big variety of terminologies to describe concepts of e-learning with different characteristics. Due to the not definite and overlapping nature of e-learning, Guri-Rosenblit (2005, p.469) attempts to clarify the ambiguity of the terms by defining the three main differentiation characteristics: proximity, target audience and costs. The proximity will be used in this study as the differentiating characteristic to distinguish e-learning from distance education. The difference in the spatial distance between students in distance education and technology-enhanced classroom teaching or distributed learning is at hand. Hence, as the terminologies for education which encompass physical interaction and the use of digital technologies are very broad in literature, these concepts will be consolidated in this study with the term e-learning.

Therefore, to not get lost in the vast amount of terms, this study is going to set the focus on distance education and e-learning. The definitions of this study conforms with the two distinct purposes that Means et al. (2009) defined in their work which performed a comprehensive review on online learning. Ultimately, this study defines e-learning as all technology-enhanced education that includes campus based education. This conforms with the definition by Means et al. (2009, p.9):

"Online learning components that are combined or blended (sometimes called “hybrid”) with face-to-face instruction to provide learning enhancement"
Distance education is in this study defined as all technology-enhanced education that is conducted purely online without physical meetings in place. Means et al. (2009, p.9) developed the following definition:

„Learning conducted totally online as a substitute or alternative to face-to-face learning“

In order to provide better understanding of the concepts of e-learning and distance education, background information on how other scholars define them these two concepts will be discussed subsequently.

As depicted, e-learning and distance education neither can be clearly distinguished as both concepts are intertwined with each other. Nevertheless, both concepts should be used in distinct manners. Guri-Rosenblit (2005) states, that even though the concepts of distance education and e-learning overlap with each other, they cannot be arbitrarily interchanged. While it would exceed the scope of this study to define the pools of terms in its entirety, this statement lead to the need to differentiate at least between e-learning and distance education.

It is an widespread opinion among teachers that e-learning means that all interactions are limited through online digital technologies (Oblinger and Hawkins, 2005, p.14). Looking back on the definition of e-learning for this study, that e-learning settings can also contain physical interaction besides pure online communication, suggests that this study does not share this opinion. Oblinger and Hawkins (2005, p.14) agree that this opinion is a misconception by teachers and that e-learning does not entail to solely utilize a single communication medium. Instead, e-learning courses can consist of a mix of online parts (e.g. an online lecture via web conferencing software) and physical meetings (e.g. a seminar in a classroom on campus). Oblinger and Hawkins (2005, p.14) further argue that this sort of setting enables universities to act more flexible and handle the increasing amounts of students and giving adult learners the chance to balance their studies with other life commitments such as work and family.

Arkorful and Abaidoo (2015) review a broad range of different definitions and discover different levels of specificity in matters of e-learning definitions. One very broad definition is from Abbad et al. (2009, p.2) who define all electronically enabled learning as e-learning. This definition leaves us with a quite broad scope on what we understand as e-learning. Technologies which would be nowadays be more seen as traditional technologies, such as aforementioned overhead projectors, can be included in the scope of ‚electronically enabled‘ technologies. Therefore, Abbad et al. (2009, p.2) narrow this definition gently down by limiting e-learning to the use of digital technologies. Referring to the discussion of the definition of digital technologies in the introduction, this narrows the scope of applicable technologies down to more modern technologies which enable online interaction and communication efforts. Example of such are software systems (e.g. LMS or for video conferencing) or hardware (e.g. computers, cameras). The traditional technologies such as the overhead projectors are hence excluded in the scope of this definition.

Although e-learning is fairly important for the future of higher education, Oblinger and Hawkins (2005, p.15) note that “the ‘e’ will slip into background” and that the focus will not be on the technology itself but on learning. They argue that technology is only the enabler and the learning itself instead of technology is in focus of the students.
However, in my point of view technology can become the focus of attention when technology does not blend in seamlessly in the educational setting. As Selwyn (2016) states, students experience (contrary to what many other researchers state) also several downsides in their use of digital technologies. Those downsides range from „minor annoyances“ (e.g. having to carry around a laptop) to major downsides (e.g. health complaints for example by constantly looking at the screen) (Selwyn, 2016, p.1012). He groups the reasons why technologies are perceived as unhelpful in the four following D’s: Distraction (diverted attention of students), Disruption (prevent students to work due to technological failure), Difficulty (hindering students due to technological difficulties) and Detriment (worse education due to quality losses caused by technologies). Such downsides of digital technologies obviously disrupt the focus of attention on learning in which case the „e’ is unlikely to slip into the background.

Besides digital technologies being able to take an disruptive role in education, e-learning has been criticized for only using a new medium to educate students in the same way like they have been educated many years back in the past without applying any major change in the course design. Bates (2015, p.108) makes use of the metaphor „Old wine in new bottles“ to refer to this phenomenon. This suggests that a change in the design of digital technologies and their use is needed and new innovative developments are desired.

Besides the education that also contains the physical contact between teachers and students, what will be called e-learning in this study, there needs to be a discussion about the distance education as well. Distance education has already been around for over a century to extend the campus education and to enable more individuals to attend higher education. It comes traditionally with a spatial distance between the teacher and the student (Guri-Rosenblit, 2005). This separation can also be apparent in time (Guri-Rosenblit, 2005). The distance gap has been bridged by different technologies throughout the years, while in the beginning learning has been done individually and not in groups (Guri-Rosenblit, 2005). We have come nowadays to more advanced digital technologies that also enable distance education teamwork, as it is suggested by Anderson and Dron’s (2011) third era. The ability to have activities such as discussions among students in online forums, enables students and teachers to have a certain degree of interaction which has not been possible in the era prior to the digital technologies (Bates, 2001, p.20).

When comparing e-learning and distance education, e-learning is lacking the spatial distance which is the distinguishing factor for the distance education (Guri-Rosenblit, 2005). Even though teachers and students have face-to-face contact in an e-learning setting, they still utilize the same or similar digital technologies to enhance and support their education (Guri-Rosenblit, 2005). Such a digital technology can be for example a learning management system, as it is for both education practices of the teachers interest to provide information, study material as well as providing a platform for interaction among students and the teacher.

Along the differentiating characteristic of the proximity, distance education and e-learning is furthermore different in regards of the target audience (Guri-Rosenblit, 2005, pp.472–473). According to several scholars (e.g. Guri-Rosenblit, 2005, pp.472–473; Simonson, Smaldino and Zvacek, 2014, p.38; Bates, 2015), distance education benefits certain social groups that are hindered to attend in the traditional face-to-face education setting. This can have different reasons such as geographical barriers, family
or job commitments, health conditions or financial backgrounds. Students can stay in their current life environment without splitting up or moving with their family to the university location, and further allows studies after the normal work day.

However, there is also a critical view on the promotion of an accessible education for all. As Lee (2017) states, the accessibility to higher education does not come on its own by extending the education with distance education. She argues that universities cannot claim accessibility to education solely by granting them to enroll in the university but rather pay attention to the situation of the disadvantaged students and the need to support them to satisfy their needs. When reflecting upon an extreme example, this would mean that an education would not be accessible for a blind person at all if the digital technologies, study materials and modes of communication are not consistently designed to be used by blind as well. Other needs of distance students may be flexible study times which is hard to achieve when distance courses are designed to have live lectures. This can make it hard for students from over the world to participate due to other commitments such as work and the time difference.

In addition to the difference in proximity and target audience, distance education differs from the cost perspective to e-learning (Guri-Rosenblit, 2005, pp.473–474). As the development and preparation of courses depict the most costly part, the economies of scale effects come into play as it enables universities to increase the amount of students attending the courses (Guri-Rosenblit, 2005, pp.473–474). The e-learning setting on campus on the other hand, although it utilizes some of the same digital technologies, cannot be scaled to that extent and therefore results into higher costs for the university (Guri-Rosenblit, 2005, pp.473–474). This makes distance education an attractive market for universities to set their foot in to capitalize these advantages.

2.4 Digital Technologies in Education

A lot of knowledge has been gained from the use of digital technologies in distance education, especially due to the application of tools for communication in the early years of distance education which subsequently benefitted campus-based higher education (Kirkup and Kirkwood, 2005, p.2). The benefit for the on-campus education is based on the experiences that teachers gained from development and application of practices and methods in the domain of distance education (Kirkup and Kirkwood, 2005, p.2).

Although e-learning technologies are replacing traditional materials such as chalkboards, textbooks, flip-charts, TVs and overhead projectors, the technology is not meant to replace the teacher nor the classroom (Bates, 2001, p.17). Therefore, there is a need for digital technologies to be designed and teachers to be trained to work together to achieve and provide qualitative education. Bates (2001, p.40) further points out that replacing the teachers would result into loosing the benefits that the technology holds. However, traditional practices are well replaceable by e-learning activities, for example, by moving some face-to-face lectures and discussions from the traditional classroom into the virtual classroom and into discussion forums (Bates, 2001, p.97). The task that researchers and teachers are facing with that is to work towards strategies and practices for a worthwhile education that meet the individual needs of the involved parties.

Besides the utilization in distance education, digital technologies such as learning management systems therefore also find application in the face-to-face education as an supporting tool (Lust et al., 2012, p.796; Kirkup and Kirkwood, 2005, p.3) and are used
in the whole world (Coates, James and Baldwin, 2005, p.19; Holmberg, 2005, p.29). The worldwide use of learning management systems suggest the interpretation that on the one hand, the use of these digital technologies shows certain parallels around the world and on the other hand, that they provide a broad scope of functions at the same time.

Digital technologies fulfill a broad spectrum of purposes from administration over teaching to research (Kirkup and Kirkwood, 2005, p.3). Digital technologies therefore have gained significance in educational settings as they have permeated the different sectors of education organizations.

LMS provide the possibility to create course pages which are used to mimic the traditional classroom setting. For example, the access to the course page is limited to in the course enlisted students and teachers. Study materials and instructions are provided for the students or announcements are published to inform them. Besides the term learning management systems, a variety of different terms have been coined throughout the years, such as learning platforms, distributed learning systems, course management systems, content management systems, portals, and instructional management systems (Coates, James and Baldwin, 2005, p.20). Two examples for such systems are Blackboard and Moodle (Islam, Beer and Slack, 2015). They enable teachers to provide study- and course- material and -resources for students, to provide room for online discussions, and to assess the students’ level of knowledge digitally (Coates, James and Baldwin, 2005, p.22).

The education benefits also from the interaction which is possible with these digital technologies such as e-mail, online conferencing systems (Holmberg, 2005, p.27) or the LMS. The interaction between teachers and students as well as feedback for students is considered to be a very important asset for the education with digital technologies (Kirkup and Kirkwood, 2005, p.7).

Digital technologies do not only allow synchronous discussions but also enable the application of asynchronous discussions where students are able to contribute whenever they want in a certain timeframe (Holmberg, 2005, p.27). Although it is often distinguished between the synchronous and asynchronous mode of teaching in the context of distance education, Algahtani (2011, p.52) state that both communication modes can appear both, on- and off-campus. Synchronous discussions can for instance be in form of a chat or video conference in which students and teachers communicate and interact with each other in real time with the advantage of immediate feedback (Algahtani, 2011, p.52; Gleim and Kuhl, 2017, p.1). Gleim and Kuhl (2017, p.2) further state that synchronous education enables teachers and students to build up social relationships and to „create a psychological closeness“. However, this interaction does not necessarily need to be under the supervision of the teacher (Algahtani, 2011, p.52). Asynchronous discussions contrariwise lack the immediate feedback as students and teachers communicate at the times that suit them by using for example discussion forums (Algahtani, 2011, p.52) or learning management systems (Gleim and Kuhl, 2017). On the other hand it enables students to follow the course from anywhere and at anytime and to plan their studies according to their life (Gleim and Kuhl, 2017). This creates great flexibility but also demands from students that they are able to organize their time accordingly. For teachers, particularly courses with a low support level throughout the course require very careful and intensive preparation as the study material needs to be precise without room for misinterpretations (Marble, Fulcher and
Toman, 2016). Gleim and Kuhl (2017, p.3) furthermore describe the possibility to combine both teaching modes, which suggests that there is no stringent separation of synchronous and asynchronous education necessary.

Blin and Munro (2008, pp.488–489) identify the insufficient training and ability of teachers to facilitate the LMS for areas of application other than administrative tasks and purposes, such as distributing information and reproducing already existing tasks. Administrative tasks are furthermore seen as unpopular and teachers would advocate a reduction of the effort that needs to be invested to fulfill these administrative duties (Kirkup and Kirkwood, 2005, p.8). Zainuddin et al. (2016, p.289) point out that the use of these technologies “critically depends on the teachers having knowledge about the tools, being aware of how they should be used and being capable of organizing all the communication process”.

The introduction of this kind of digital technology is driven by various factors such as an promised efficiency increase, improved student learning, as well as the increased competition among universities or students expectations (Coates, James and Baldwin, 2005, pp.23–28). It further reshapes the daily teaching practices and teachers need to be introduced to new technologies so that they are able to adapt their practices accordingly (Coates, James and Baldwin, 2005, pp.29–30). Contrary to the prediction that digital technologies in higher education will disrupt the teaching practices, Blin and Munro (2008) conclude that they have only identified little disruption caused by LMS. Digital technologies have further advanced distance education, which enables a broad new audience to have access to education (Holmberg, 2005, pp.33–36). This audience may consist of individuals that do not have access to traditional education due to reasons such as their geographical, social or professional situation (Holmberg, 2005, pp.33–36). Examples for that is someone who lives too far away from higher education institutions, or who wants to combine work, family and studies (Holmberg, 2005, pp.33–36).

The OECD (organization for economic co-operation and development) – a collaborative forum of governments from around the world – works on the challenges of globalization which addresses the management issues of educational innovations in a report in 2010. The OECD (2010, p.3) accredits digital technologies in education an important role and finds that numerous countries invest considerably to increase accessibility and the digital technologies themselves. They assess digital technologies as necessary to ensure future improvements in education and to harvest the opportunities which the technologies open up for education (OECD, 2010, p.14).

Educational technologists, according to the OECD (2010, p.25), share the belief that digital technologies further provide the best learning environment for students in order to consume and create content within their educational network and refer to Hargadons (2008) label as „the future of education“.

2.5 Related Studies with Technology Beliefs, Attitudes and Barriers in Education

This study examines the attitudes of teachers towards their digital technology use in education and therefore the teachers themselves are to begin with in focus. According to the OECD (2010, p.3) “human capital is at the heart of the innovation process”.

On a positive note, the OECD (2010, p.15) notes that the majority of teachers from OECD countries have access to digital technologies and the technical skills to utilize the technologies at least on a basic level. Furthermore, the report states that most teachers
believe in the benefits that digital technologies promise for the education perceive them as useful. This open-mindedness appears to be fundamental for the adoption of digital technologies in education, as according to Tondeur et al. (2017, pp.14–16), the pedagogical beliefs of teachers can pose a barrier to digital technology integration. These beliefs can clearly hinder the innovation process the OECD refers to. Whereas the OECD argues that teachers generally see the benefits of digital technologies in education, Tondeur et al. (2017, pp.14–16) disagree and argue that teachers have the potential to either do not see a need to use modern technologies (based on their own satisfaction with traditional approaches) or perceive the digital technologies as troublesome and therefore sense them as barriers to successful teaching.

Also Liu et al. (2017) embrace the possibility that barriers can emerge due to the teachers’ attitude towards the digital technologies. They refer to them as internal barriers and argue that they are harder to identify and deal with the perception and attitudes teachers and other staff in the educational institution feel towards the digital technologies (Liu et al., 2017). They relate one of the internal barriers to the lack of encouragement teachers experience from superiors and colleagues. Also a lack of confidence in their own computer competence is brought up as an internal barrier which eventually can lead teachers to avoid the digital technologies. A further internal barrier Liu et al. (2017) refer to is the lack of incentives and motivations which entails that teachers lack appreciation or rewards for their efforts to use the digital technologies.

The second perspective on barriers by Liu et al. (2017) are respectively the external barriers. They describe external barriers as factors that are related to a lack of resources. Common external barriers found in literature are according to them limited time, money, support, and training. Other scholars approve that, such as Tondeur et al. (2017, pp.14–16) who identify the lack of time as a major concern that teachers have when making use of the digital technologies in their teaching. Others felt a lack of control when trying to integrate digital technologies into their classroom. Furthermore, the lack of incentives depicts one of three barriers the OECD (2010, p.16) which are identified in their report concerning the digital technology adoption for education.

The lack of support and management can also be identified on an higher level than the institution-teacher relationship. As Garrison and Kanuka (2004) state, there is often a lack of mutual management of the digital technologies which ultimately leaves the responsibility in the hands of single faculties. They further stress the importance of the human and the ability of using the technology, customizing the teaching curriculum and providing support for it.

Furthermore, Simonson et al. (2014, pp.68–69) refer in their recent work to a list by Berge and Muilenburg (2000) identified challenges that teachers are facing. Although their findings focus on particularly distance education, the barrier of the lack of time is noticeably the most significant barrier identified throughout all job positions (e.g. teachers, administrators, support staff) they investigated. In respect of the focus of this study on the challenges that teachers face, the following ranking refers to the ten most relevant barriers to the teaching faculty (Berge and Muilenburg, 2000):

1. Increased time commitment
2. Faculty compensation, incentives, etc.
3. Lack of money to implement distance education programs
4. Lack of shared vision for distance education in organization
5. Lack of support staff to help course development
6. Lack of technical support
7. Organizational resistance to change
8. Lack of strategic planning for distance education
9. Lack of technology-enhanced classrooms, labs or infrastructure
10. Difficulty keeping up with technological changes

Taking a look back onto the internal barriers defined by Liu et al. (2017) the second, fourth, seventh and tenth barrier from this descendent list of relevance can be attributed to the internal barriers. The second barrier by Berge and Muilenburg (2000) “Faculty compensation, incentives, etc.” also identify similarly to Liu et al. (2017) that the attitude towards digital technologies can be negatively affected when incentives are not offered for the teachers additional effort to employ digital technologies in their curriculum.

The barriers concerning the lack of a shared vision, the organizational resistance to change and difficulties to keep up with technological changes can imply that teachers or other relevant staff occupy diverging (and possibly negative) perspectives towards the use of digital technologies in education.

Concerning the other barriers identified by Berge and Muilenburg (2000) it can be observed that these match to the external barriers from Liu et al. (2017), such as the lack of money and support. They also identify additional barriers that can be attributed to the perspective of external barriers, e.g. the lack of technology-enhanced classrooms, labs or infrastructure. The report by the OECD (2010, p.16) presents similar barriers and states that the training of the teacher is insufficient. Teachers are not properly trained on how to use the digital technologies in a meaningful way and lack proper guidance. Further, the third and last of the three barriers presented by the OECD is the lacking knowledge how the digital technologies can be applied pedagogically to achieve qualitative and well performing results.

Porter et al. (2016) have a different perspective and examine three factors that influence teachers and on which teachers base their decision on whether or not to adopt the use of digital technologies. Their findings are alike the above discussed external barriers but lack the perspective of attitudes. These factors appear to be based rather on rational arguments than on the emotional characteristics of teachers’ attitudes and beliefs.

The first factor relates to the institutional and organizational strategies in place. As an example, teachers perceive the existence of policies and guidelines, which guide but not enforce the digital technology use, as an important strategy asset (Porter et al., 2016). Teachers furthermore perceive the need of having advocates with hands-on experience. This is desired due to their concern that administrators may have diverging motives from the teachers about how digital technologies should be used.

The second important factor for the teachers, according to Porter et al. (2016), is the structure of the institution. This entails that teachers care about criteria such as the infrastructure which means that technologies need to be reliable, or that teachers want to be empowered to adjust their course instructions type to the institutional needs. Another important structural aspect for teachers is the transparency towards the student. They stress the need for everyone of the students to be aware what they can expect from the course and understand its characteristics (e.g. understand the difference between blended learning and traditional learning approaches).
The third and last factor, ‘support,’ overlaps the most with the barriers identified by the other scholars. Besides referring to the demand of the technical support, Porter et al. (2016) in addition identify the importance of pedagogical support for teachers. Their demand lies in the support in designing and integrating a technology enhanced course and providing examples on what is possible with the technologies. This relates also back to the prior presented findings of the OECD that teachers lack knowledge on how to pedagogically connect digital technologies and education in a reasonable way.

These influential factors identified by Porter et al. (2016) depict rather rational criteria that teachers base their decision for or against digital technology use in education. However, based on my understanding, these factors can transform into barriers when teachers motivate their rejection of a digital technology based on one or more of these factors.

Besides the barriers and factors, Englund et al. (2017) bring in an alternative stance to the discussion that concerns the influences which form teachers conceptions towards the use (or non-use) of digital technologies in education. Their longitudinal study of 10 years at a Swedish university reveal that very experienced teachers tend not to (or only very little) change their strategy of traditional teaching towards a technology enhanced teaching. Among researchers, this change implicates a change of the overall pedagogical belief from a teacher-centered to a student-centered approach (Englund, Olofsson and Price, 2017, p.2). They justify this resistance to change with the teachers own satisfaction with their strategy and them not feeling the need to change.

As a concluding remark, Flavin (2016, p.633) acknowledges these downsides of digital technology adoption in teaching and criticizes that the use of digital technologies are missing out on their possible potential, and states that the pool of digital technologies to support the education is permeated with alternative technologies which are not sufficiently introduced and supported by the universities.

2.6 Conclusions of the Literature Review

The work presented above shows that education in combination with technology has already a long history. Starting with (from today’s point of view) rudimental technologies, such as slate or blackboards, have taken a prominent role in education ever since. The literature review shows that the development to the point of digital technologies as we know them today has gone through a plethora of different concepts and terminologies in order to describe this constantly changing environment and a universally accepted definition and distinction of them is hardly possible.

Digital technologies change the nature of education and open up many opportunities for the universities, the teachers and the students. Digital technologies open up higher education, and students are able to join higher education regardless of their private commitments such as work or family. This, in return, opens up a whole new business sector for the universities. Digital technologies further enable teachers for example to explore whole new pedagogical strategies concerning their education and apply concepts such as the flipped classroom.

However, the reviewed literature also shows that an appropriate application of digital technologies in education stands and falls with the underlying attitude and beliefs of teachers towards digital technologies as well as adequate consideration of a series of barriers. The study shows that fundamental barriers, which teachers and institutions face
when adopting digital technologies in education, consist of a lack of time to use the technologies, a lack of technical and pedagogical support as well as compensations and incentives not being provided by faculties.

Concluding, the studies show that these barriers also have an direct impact on the teachers attitude towards digital technologies and their willingness to use them for their education.
3 Research Methodology

This chapter discusses the methodology of this study. First, the research strategy and the paradigm are being discussed. It follows a presentation of the empirical setting including an insight about the study participants. Subsequently, the data collection and analysis approach are discussed before this chapter takes a glance at the validity and reliability of the study. The chapter closes with a discussion about the relevant ethical considerations.

3.1 Research Strategy and paradigms

There are two different approaches that researchers can follow when conducting research, the qualitative and quantitative approach. While quantitative research analyzes the statistical distribution of a large amount of numerical data, the on verbal data based qualitative research aims to identify the worldviews and experiences of people and attempts to understand how they interpret and make meaning out of them (Merriam and Tisdell, 2016, p.6). This study is going to follow a qualitative approach as it enables to examine the personal experiences of teachers with the use of digital technologies in depth. Flyvberg (2006, p.241) attributes the qualitative approach the advantage to examine in depth rather than having a broad sample.

Creditable research underlies different understandings and assumptions of the world. As Creswell (2014, p.6) states, several terminologies have been established over time but these assumptions are typically referred to as paradigms among scholars (Elshafie, 2013; Guba and Lincoln, 1994; Black, 2006), epistemologies and ontologies (Crotty, 1998) or Creswell himself refers to the term worldview.

A paradigm is, as Guba and Lincoln (1994, p.105) define it, the “worldview that guides the investigator, not only in choices of method but in ontologically and epistemologically fundamental ways”. Ontology conceives how the world is composed and tries to answer the question how the “nature of reality” looks like (Crotty, 1998, p.10; Guba and Lincoln, 1994, p.108; Elshafie, 2013, p.5). According to Guba and Lincoln (1994, p.108) in an alleged real world ontology would then depict “how things really are”. Epistemology refers to the understanding of “how we know what we know” (Crotty, 1998, p.3) or in other words to the “theory of knowledge” and lies the foundation to answer the question on how we are perceiving the world (Crotty, 1998, p.8).

The main research paradigms in information systems research constitute the positivist, the interpretivist and the critical paradigm (Elshafie, 2013, p.4; Orlikowski and Baroudi, 1991) whereas this study is situated in the interpretive paradigm. This study understands the interpretive paradigm according to the definition by Orlikowski and Baroudi (1991, p.6):

“Interpretive studies explicitly adopt a nondeterministic perspective, attempting to explore the phenomena of interest in its natural setting, deliberately not imposing any a priori understanding on it”

In relation to this study, the interpretive paradigm maps to the research goal to examine the perception of digital technologies used in its natural setting, which encompasses the everyday teaching activities from teachers at the Linnaeus University in Sweden. Furthermore, the interpretive paradigm implies an interaction between me, as the researcher, and the different research participants (Walsham, 2012, p.376) and that
naturally interpretive paradigm yields into distinct worldviews among the participants (Elshafie, 2013, p.7). This denotes for the study that different attitudes and conflicting views on the barriers of digital technologies are to be expected and, as a matter of course, are desirable. Given that the study is conducted among human individuals it is important to note that the collected data is biased by the preconceptions of the world from the researcher and the research participants (Walsham, 2012, p.376) which can be shaped by collective unconsciousness, dreams or religious beliefs (Gray, 2013, p.20). The study therefore will only capture the personal and subjective realities of the teachers and not one objective true reality.

3.2 Empirical Setting
The empirical setting and respectively the organization of interest for this study is a young higher education institution in southern Sweden. With its around 31,000 students and 150 programs the Linnaeus University (Lnu) incorporates a variety of different fields of expertise and research such as humanitarian studies, social sciences, engineering, timber technology or energy technology (Lnu, 2016a). Lnu offers undergraduate, postgraduate as well as PhD study programs.

The university is mainly located in the two cities of Växjö and Kalmar and has emerged in 2010 from the merging of Växjö university and University of Kalmar. Beside the traditional on-site education Lnu offers a variety of distance based study programs. The selection of participants for this study has been limited to employees located on Campus Växjö.

The organization of the Lnu is divided into the following five faculties (see Table 3-1): School of Business and Economics, Faculty of Health and Life Sciences, Faculty of Arts and Humanities, Faculty of Social Sciences, and the Faculty of Technology (Lnu, 2016b). These faculties are each subdivided into at least four and up to nine different departments that specialize in the respective field of expertise. Further, the additional educational section for the Board of Teacher Education pervades all the other faculties and departments, and is composed by representatives of the different faculties (Lnu, 2016c).

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Business and Economics</td>
<td>Economics and Statistics, Department of Accounting and Logistics, Marketing, Organization and Entrepreneurship</td>
</tr>
<tr>
<td>Faculty of Health and Life Sciences</td>
<td>Biology and Environmental Science, Chemistry and Biomedical Science, Health and Caring Science, Medicine and Optometry, Psychology</td>
</tr>
<tr>
<td>Faculty of Arts and Humanities</td>
<td>Cultural Science, Design, Film and Literature, Languages, Media and Journalism, Music and Art, Swedish</td>
</tr>
<tr>
<td>Faculty of Social Science</td>
<td>Education, Pedagogy, Political Science, Social Studies, Social Work, Sport Science</td>
</tr>
<tr>
<td>Faculty of Technology</td>
<td>Building Technology, Built Environment and Energy Technology, Computer Science, Forestry and Wood Technology, Informatics, Mathematics, Mechanical Engineering, Media Technology, Physics and Electrical Engineering, (Maritime Academy)</td>
</tr>
</tbody>
</table>

Table 3-1. Faculties and Departments at Lnu
One to two employees of each faculty have been interviewed once. They take over diverse roles in the organization ranging from program responsibles, professors, senior teachers, teachers to PhD students. Some of them also take over several roles such as being a teacher and a PhD student. In total 9 teachers (1-9) have been interviewed. The faculties do have own educational technologists that are available for pedagogy related questions for above mentioned teaching staff. To complement the insights from the interviews with the teachers one of this educational technologists (10) has been interviewed supplementary. Furthermore, one e-learning specialist (11) with a more abstract view on the digital technologies for teaching has been interviewed.

In addition to the interviews, a focus group (A,B,C,D,E) has been conducted with 5 representative teachers from the Faculty of Technology, the Faculty of Social Science and the School of Business and Economics.

**Study participants**

Marshall (1996, p.525) points out that while sampling strategies are theoretically separable, the separation in practice is not necessarily needed and can overlap. This study however is mainly going to follow the strategy of a purposeful sample which, according to Marshall (1996, p.523), consists of thoughtfully chosen participants, because this study examines the digital technologies used at Lnu by teachers. Therefore, the sample will consequently consist of staff from Linnaeus university and the majority of them are teachers.

In order to avoid a unilateral examination of the situation in the organization, this study deliberately intends to include teachers of as many faculties as possible from the organization. Therefore, the data collection, is broadened by looking into all educational units of Lnu. To complement the perceptions of teachers the study will also include a small amount of non-teacher perspectives. Appropriate perspectives from non-teachers are expected to result from educational technologists as their role in the organization is to support teachers to improve the incorporation of digital technologies in their everyday teaching activities. The other non-teacher perspective that will be included in the data collection is the e-learning specialist who is expected to have an more abstract perspective on technologies used in higher education, at Lnu, and in Sweden. Due to the inclusion of both, the educational technologist and e-learning specialist, information about common problems and struggles that teaching staff encounters can be collected to a greater extent.

The teachers that represent the sample are not going to be selected randomly as this is perceived as insufficient to achieve a purposeful sample. Therefore, this study will follow recommendations and is going to avail itself on the ideas of a snowball sample to fulfill the strategy of a purposeful sample. A snowball sample makes use of the snowball effect and reaches more participants through further iterations of recommendations (Bryman, 2016, p.415). For this study, I am going to adopt the idea of recommendations as I believe recommendations can lead to a meaningful improvement of the sample quality. I therefore followed recommendations from either the heads of the particular faculty or from faculty educational technologists. In one case I followed the recommendation from two fellow students who got to know the teacher in undergraduate courses. In two cases the participants recommended me to talk to one of their colleagues which I have followed.
Regardless of the origin of the recommendation, whether it came from a faculty head, an educational technologist, a student or an participant, it has enriched my sampling as all these persons know the potential participants well.

The participants for the focus groups have been selected in a similar way by following recommendations from someone in the organization who knows the academic staff well. Eventually, the focus group consisted of a total of five participants coming from three different faculties at Lnu. The focus group turned out to have a good composition of different experience levels in higher education.

After presenting the theoretical foundation and the strategy concerning the sample selection, the following sections give an overview of the different participants by stating their gender, role at the university as well as their experience in higher education and at the university. As the university was created through the merging of two universities in 2010 (Växjö University and University of Kalmar) some participants have experience at either one of the locations beyond the official existence of Lnu. For the sake of convenience this experience is not separately indicated.

In order to preserve the anonymity of the participants no names, ages or affiliation to the department are given. For anonymity purposes also the affiliation to the faculty is omitted for the educational technologist and e-learning specialist. Further, the years of the participants’ experience are not exact but approximate values for orientation. In order to distinguish among the participants, the study coded the names of the interviewees in ascending order from Participant 1 to Participant 11. The names of the focus group participants are coded alphabetically from Participant A to Participant E. The same codification of the participants’ identity will be found again in the empirical findings (see chapter 4).

The table below (see Table 3-2) illustrates the role and experience of all participants with whom interviews were conducted. Participant 1 to 9 are all involved in teaching duties but possess different roles such as program responsible, professors, senior lecturers or PhD students. Participants do not necessarily only possess one role, but can be for example employed as an teacher and PhD student. The research efforts of respective participants are not captured due to it being irrelevant.

The participant 10 is an educational technologist (or referred to as IT pedagogue). Every faculty at Lnu has one or more educational technologists in order to help and support teachers with pedagogical issues concerning the digital technologies they use. This can be for example entail support with how to incorporate technologies in the course design or fundamental help how to use the functions of the digital technologies imposed by the university.

Participant 11, the e-learning specialist, defines his role as very broad and not clearly definable. He describes his role as being an expert in digital technologies for education, which includes monitoring the market and current trends and eventually spreading the word through various channels. He maintains blogs, newsletters, social media and an compendium of additional tools utilisable for education which is accessible for the public. The role as an e-learning specialist furthermore entails speaking at conferences, guest appearances on teacher trainings and project work at various universities.
Table 3-2. Professional experience of interview participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Role at LNU</th>
<th>Experience in higher education¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, female</td>
<td>Program responsible &amp; professor</td>
<td>&gt;20 years of experience; ~9 years at Lnu</td>
</tr>
<tr>
<td>2, male</td>
<td>Senior teacher</td>
<td>&gt;13 years of experience, ~1 year at Lnu</td>
</tr>
<tr>
<td>3, female</td>
<td>Part-time teacher &amp; part-time PhD student</td>
<td>6 years of experience at Lnu</td>
</tr>
<tr>
<td>4, female</td>
<td>Program responsible</td>
<td>&gt;30 years of experience, ~11 years at Lnu</td>
</tr>
<tr>
<td>5, female</td>
<td>Senior teacher</td>
<td>&gt;19 years of experience, ~17 years at Lnu</td>
</tr>
<tr>
<td>6, female</td>
<td>Program responsible &amp; teacher</td>
<td>~8 years of experience at Lnu</td>
</tr>
<tr>
<td>7, male</td>
<td>Part-time teacher &amp; part-time PhD student</td>
<td>~8 years of experience at Lnu</td>
</tr>
<tr>
<td>8, male</td>
<td>Professor</td>
<td>25 years of experience, ~12 years at Lnu</td>
</tr>
<tr>
<td>9, male</td>
<td>Senior teacher &amp; program and course responsible</td>
<td>~8 years at Lnu</td>
</tr>
<tr>
<td>10, female</td>
<td>Educational technologist</td>
<td>&gt;16 years of experience in her role</td>
</tr>
<tr>
<td>11, male</td>
<td>E-learning specialist</td>
<td>&gt;13 years of experience</td>
</tr>
</tbody>
</table>

Table 3-3. Professional experience of focus group participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Role at Lnu</th>
<th>Experience in higher education¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, female</td>
<td>Teacher assistant</td>
<td>3 years of experience</td>
</tr>
<tr>
<td>B, male</td>
<td>Teacher</td>
<td>n/a</td>
</tr>
<tr>
<td>C, male</td>
<td>Teacher</td>
<td>~7 years of experience</td>
</tr>
<tr>
<td>D, female</td>
<td>Part-time teacher &amp; PhD student</td>
<td>3 years of experience</td>
</tr>
<tr>
<td>E, female</td>
<td>Teacher</td>
<td>n/a</td>
</tr>
</tbody>
</table>

¹ The experience at the predecessors from Lnu (Växjö University & University of Kalmar) are not shown separately and are included here
Eventually, the number of participants of the interviews and the focus group were slightly in favor for female participants (9 female out of 16). The teachers, whether from the interviews or the focus group, belong as following to the different faculties of Lnu:

- School of Business and Economics: Participant B, 1 and 8
- Faculty of Health and Life Sciences: Participant 3 and 7
- Faculty of Arts and Humanities: Participant 5 and 6
- Faculty of Social Science: Participant E, 2 and 4
- Faculty of Technology: Participant A, C, D and 9

3.3 Data collection
This chapter deals with the data collection of the study. The data collected for this study originates from a variety of data sources. Those are a pilot interview, semi-structured interviews and a focus group.

3.3.1 Semi-structured Interviews
The decision to conduct a semi-structured interview in this study lies in the flexibility that it inherits but still offers me as the researcher to guide the conversation towards the desired subject (Merriam and Tisdell, 2016, p.110). This flexibility allows me to focus on particularly interesting issues that the participants come up with and adapt my questions to their view on their own individual situation (Merriam and Tisdell, 2016, pp.110–111). Due to the fact that I, as a researcher, do not have a full insight on what technologies the teaching staff at Lnu uses, these circumstances of semi-structured interviews are perceived as a helpful tool for the data collection. It enables me to talk about problems that really matter to the staff even though one specific technology was not on my radar before.

Being able to change the structure of the interviews came in very handy when the e-learning specialist was interviewed. As my prior perception of his professional work turned out to be a bit off the reality, the prepared questions for the semi-structured interview turned out to be not optimal as the interviewee was not able to answer them in the way I expected it. Instead, he looked on the topic from a more abstract level and enabled me to adjust some of my questions to gain deeper insight on this new perspective.

The interviews were nonrecurring and took from 45 minutes up to 60 minutes and were conducted in the office of the respective employee on campus Växjö. One interview was conducted via the video conferencing software Skype. Besides taking notes, after the participants have given their consent, the interviews have been recorded with a redundant setup of the researchers laptop and mobile phone. This was to prevent any kind of data loss, corrupted or unusable data due to technology failures.

3.3.2 Pilot Interview
As information about how and with which technologies teachers at Lnu work, and about the nature of problems they encounter cannot simply be found in academic publications, I have conducted a pilot interview to get my understanding of the teaching practices acknowledged and extended. The pilot interview further enabled me to test my interview guide before adopting it in the main interviews and adjust it accordingly (Kvale, 2007, p.46). This was necessary to get possible indications of misunderstood questions and to minimize the ambiguity, if any of the questions make the interviewee
feel uncomfortable, or if questions are too complex to answer and need to be broken down more. It further enabled me to test if the amount of questions are applicable for the set time limit of one hour. Therefore, the pilot interview was conducted with a teacher that matches the target group of the study (Turner, 2010, p.757) and under the same conditions as the main interviews were planned. During the pilot interview, I paid attention to if the interviewee hesitated to answer and if the interviewee needed clarification for her understanding of the question. Further, the interviewee pointed out ambiguous questions. Findings of the pilot interview were used to review, change and clarify the interview guide.

3.3.3 Focus Group
Beside interviews, the study utilized a focus group in order to obtain additional information about how the digital technologies are perceived. An important asset that focus groups add is an social dimension among the participants (Ryan et al., 2014, p.328). Discussions can arise through the meeting with a group and may give a more comprehensive insight of what people think (Ritchie and Lewis, 2003, pp.171–172; Cook and Crang, 1995, p.56). Further, statements from an participants can trigger reactions, reflections and opinions from the other participants and therefore provide more data (Ritchie and Lewis, 2003, pp.171–172). Due to the discussion, the participants are facilitated to remember issues they had with digital technologies which they would not have thought of in an interview. This makes the method of a focus group a good complement to the interviews. The study consisted of one focus group with a group size of five participants and therefore lies within the usual size between 4-8 participants (Ryan et al., 2014, p.329). The aim was to bring teachers of the different faculties together in order to have a diversified group and insights. The participants of the focus groups are different from the ones from the interviews.

The focus group was nonrecurring and did not extend 1 ½ hours of time which lies within common focus group durations (Cook and Crang, 1995, p.58; Ryan et al., 2014, p.329). Besides taking notes, the focus group session was recorded redundantly after the participants have given their consent. The recording of the focus group was used to summarize the result afterwards and to retrieve single meaningful quotes from the participants. The focus group started with explaining the participants the content and purpose of the study. The focus group follows a social constructionist approach where „opinions are „socially shared knowledge” or tacit knowledge that is generated, maintained, and changed through social participation“ (Ryan et al., 2014, p.331).

As the time for the focus group was limited to 1 ½ hours, I did not intend to spend a lot of time identifying all the different digital technologies in use with the participants together as these were covered already extensively in the previous nine interviews with other teachers. Therefore, as Ryan et al. (2014, p.329) suggests, stimulus material has been applied in the beginning of the focus group.

As a stimulus, the inspiration card data collection method has been applied which is a commonly used method in the participatory design field (van der Velden and Mörtberg, 2014, p.14). The method makes use of cards that represent a certain concept of interest by adding e.g. a image, title, or description on the card in order to inspire the participants in their creative process (Halskov and Dalsgård, 2006, pp.3–5). This method encourages the researcher and participant to engage with each other and furthermore enhances the communication (Wölfel and Merritt, 2013, p.481). As the
name of the method reveals, the inspiration cards were used in this setting to inspire the participants about the digital technologies they use in their everyday teaching activities. As Wölfel and Merritt (2013, p.482) suggest, the inspiration cards combine pictures and text, and therefore the cards for this focus group consisted of a screenshot of the user interface and the name of the digital technology in characters like in the example below (see Figure 3-1).

Advantages of the use of inspirations cards are the simplicity, tangibility and susceptibility to manipulation (Wölfel and Merritt, 2013, p.479). The five inspiration cards used in this study cover the five most prevalent technologies (My Moodle, Adobe Connect, TimeEdit, LnuPlay and E-Mail) according to the interviews data and were presented to the participants in the beginning of the focus group. Three additional blank cards were provided to enable the participants to add technologies to the discussion and to an avoid artificial limitation of the discussion basis.

![Inspiration Card Example for MyMoodle](image)

The aim of the social constructionist approach of the focus group is to facilitate a natural conversation among the participants and to follow a loose structure (Ryan et al., 2014, p.331). Therefore, the inspiration cards provided a first loose structure which the participants used to decide upon the technologies they wanted to discuss about most.

Further, questions were prepared to initiate the discussion among the participants and to gently guide them to cover the areas of interest respective the research question. The researchers participation was limited to moderate the discussion.
3.3.4 Summary of data collection methods

To conclude, a total of 16 individuals were involved in the data collection which split up as it can be seen in Table 3-4.

<table>
<thead>
<tr>
<th></th>
<th>Interview</th>
<th>Focus Group</th>
<th>Additional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>9</td>
<td>5</td>
<td>The faculty affiliation of the 14 teachers spreads over the five different faculties at Lnu. The majority of the participants has a fair amount of experience in higher education</td>
</tr>
<tr>
<td>Educational technologists</td>
<td>1</td>
<td>0</td>
<td>The educational technologists help and support teachers with the use of digital technologies concerning their teaching activities</td>
</tr>
<tr>
<td>E-learning specialist</td>
<td>1</td>
<td>0</td>
<td>The e-learning specialist monitors the market and trends concerning digital technologies for education and spreads the word</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>5</td>
<td>Everyone from the total of 16 participants took part in one single interview/focus group session</td>
</tr>
</tbody>
</table>

Table 3-4. Amount of Participants

The teachers have teaching duties at different faculties and the two interviewees that are not teachers are an e-learning expert and an educational technologist. The focus group only consisted of individuals with a teaching duty. A detailed breakdown of the participants is given in the empirical findings (see chapter 3.2).

3.4 Data analysis

In order to organize and interpret the raw data, this study makes use of the thematic analysis. Thematic analysis aims to transform raw data into meaningful concepts or themes and processes the data from coding to categorizing to concepts (Lichtman, 2013, pp.251–252). The author names these the three C’s of analysis (see Figure 3-2).

![Figure 3-2. Three Cs of Data Analysis: Codes, Categories, Concepts](Lichtman, 2013, p.252)
Lichtman (2013, p.252) describes the thematic analysis as a six step process:

**Step 1. Initial coding.** Going from responses to summary ideas of the responses
**Step 2. Revisiting initial coding**
**Step 3. Developing an initial list of categories**
**Step 4. Modifying initial list based on additional rereading**
**Step 5. Revisiting categories and subcategories**
**Step 6. Moving from categories to concepts**

In order to organize and make sense of the data, the process of analyzing the data started with a careful transcription of the eleven interviews that were conducted in the data collection phase. Apart from translating a few single Swedish words into English no further translation was needed as all interviews were conducted in English. During the process of transcribing, all passages that seemed particularly interesting were highlighted as preparation for the following coding. The transcripts were then compared to the handwritten notes that were taken during the interviews and missing non verbal information was added as a comment. Vaismoradi et al. (2013, p.401) refer to this preparation process as „familiarising with data“.

**Step 1. Initial Coding**
After the preparation in form of the transcribed interviews was done, the coding process started with the printed transcripts. Important words, phrases or paragraphs under consideration of the research question were underlined and the codes in form of words or small phrases were written on the page margin.

The codes were then added into an excel sheet by stating additionally the interviewee, the corresponding technology (if applicable) and the previously underlined section of the text as a quote. Further, the quotes were indexed with ascending numbers starting from one. This organizing was done to not lose the context in which a statement from a interviewee was made and to ease the retrieval of the information later in the process. The initial coding of all interviews resulted in approximately in around 150 different codes.

**Step 2. Revisiting initial coding**
While adding the codes with the respective information a first presorting has been performed and duplicate codes were merged together. All codes were reviewed and some of them, if applicable, were renamed. This was done to remove redundancies and to create a consistent data set. After the last revisiting of the codes was performed the initial codes reduced down to a code amount of 108 codes.

**Step 3. Developing an initial list of categories**
Through the prior sorting and renaming of the codes naturally a first selection of categories revealed themself which got refined by revising them again.

**Step 4. Modifying initial list based on additional rereading**
The process of the initial coding has been repeated iteratively until no new codes were identified. Further, the categories were reviewed to resolve redundancies and combine categories.
Step 5. Revisiting categories and subcategories
With a further look at the categories some categories appeared more and other less important. Irrelevant data has been excluded from the data set at this point. Eventually I ended up with twelve categories.

Step 6. Moving from categories to concepts
Reviewing the categories another time, key concepts (or themes) are identified by reflecting upon the categories and the underlying data. In the end, each key concept is named as descriptive as possible. After the sixth step has been conducted, the raw data has been refined down to four main concepts.

The analysis of the focus group was conducted in the same way as the interviews with the exception that they have not been transcribed as it is hard to put the natural flow of a discussion between multiple people down to paper in a comprehensible way. Instead, the focus group was summarized and single relevant statements from the participants were down written down.

3.5 Validity and reliability
In order to ensure the credibility of research the two concepts of Validity and Reliability have established in the scientific community, whereas Validity is referred to as the “stability of findings“ and Reliability is described as the “truthfulness of findings“ (Silverman, 2014, p.83). In other words, validity means that the research is well-grounded and justifiable, and that it follows logically correct and valid arguments. Reliability means that decisions in the research process are made coherent and that they are reproducible so that future researchers are able to repeat the same study and can expect the same results.

There are many different strategies that can be applied to ensure the validity of a research. As the concept of validity originates from quantitative research not all of these concepts are appropriate for qualitative research, which motivated Silverman (2014, pp.90–105) to suggest a handful of appropriate strategies, one of them being the „constant comparative method“. In this method, gathered data will be compared to data (which preferably originates from another case) to test and ensure the validity of the findings. However, according to Silverman (2014, p.99), data from the same case can be compared as well by performing the data collection and data analysis simultaneously. Therefore, this study applies the constant comparative method and moves from a small data set to the larger and full data set. In this process, the data is transcribed, codified and categorized step by step and new emerging data is compared to the already processed data.

To ensure the reliability of a qualitative study which has interviews as its main data source, it is crucial that there is no diverging understanding among the participants concerning the interview questions (Silverman, 2014, p.87). Therefore, the research questions were carefully formulated and a pre-testing of the interview questions was performed in the form of a pilot interview (see chapter 3.3.2). To reduce the impact of the researcher on the raw data to a maximum, the interview data has been described carefully.

Furthermore, the empirical setting, methodology and analysis is described accurately to ensure the possibility to conduct this study again under the same circumstances.
3.6 Ethical considerations

Due to the interplay between researcher and the participant, the ethical component is a crucial element of this study in order to protect the dignity and safety of the study participants (Silverman, 2013, p.160). Naturally, each participant approved to be part of this study by signing the consent form which can be found in Appendix C and D.

However, before signing the consent form, the purpose of the study and the reason of the participants involvement in the data collection process has been explained to him/her. As Elshafie (2013, p.8) states, privacy as well as the confidentiality are crucial characteristic in research from an ethical standpoint. Both have been ensured towards the participant. After explaining the benefits of an audio recording and confirming the exclusive use of the recordings and the resulting transcriptions within the context of the study, the participant has been asked for permission to record.

The participant has been made aware that his/her participation is entirely voluntary and that s/he has the opportunity, regardless of his/her prior agreement, to withdraw from the study at any given time.

After receiving the signed consent form, the participant was given a copy of the consent form which contains besides the researchers contact details all relevant information regarding the study.

To conclude, the following ethical principles on the basis of Silverman (2013, p.161) build the fundament for this study:

- Voluntary participation and the right to withdraw
- Protection of the study participants
- Obtaining informed consent
4 Empirical finding and analysis

This section presents all the empirical findings which have been gained through the data collections. The findings are based on interviews with nine teachers, an educational technologists and an e-learning specialist as well as one focus group with five teachers, all employed at Linnaeus University, Sweden as introduced in the empirical settings (see chapter 3.2). All quotes indicate at the end of the quote its origin by adding the number or character in brackets (e.g. (P1) for Participant 1) which has been defined in the empirical settings chapter (see chapter 3.2). In order to improve the readability, the quotes have been rephrased from the spoken into the written language. Further, minor adjustments such as removing duplicate words, adding punctuation, and adding comments for better understanding. All of these adjustments are made without changing the meaning of the statements from the participants.

4.1 Findings
The data has revealed four different main concepts (see Figure 4-1): Current use and Future ideas, Expressed attitudes towards teaching with technology, Barriers in the use of technology and strategies to circumvent barriers.

Figure 4-1. The four main concepts

The first concept deals with the main technologies that are currently used in the educational setting at Lnu according to the collected data. Furthermore an insight will be given for what tasks these technologies are used for and what purpose they serve. Afterwards, a short outline will be given about the future ideas of the teachers and what technologies or functionalities they desire are missing.

The attitudes towards the digital technologies in education are covered in the second concept. This concept provides data to the if teachers have rather an positive or negative attitude towards the use of digital technologies in their education. This concept further covers the attitudes and feelings of teachers when confronted with the downsides of technologies and when encountering barriers.

The third concept, barriers in technological use, depicts the most extensive concept. It contains the major barriers that the teachers experience according to the data. These barriers are divided into further categories and each respectively contains examples given by the participants during the data collection.

How teachers deal with these barriers is covered in the fourth concept: Strategies to circumvent barriers. The teachers have found a variety of ways to achieve an - for them - satisfying result when encountering barriers with technologies. These are described in this last of the four concepts.
4.2 Current use and Future ideas

The data from the interviews and the focus group shows that the participating teachers use a broad variety of different digital technologies in their everyday teaching practices. The majority of these technologies are imposed by the university and are used by all teachers to a certain extent, while the use of additional technologies has been actively decided on by either the respective faculty or the teachers themselves. Consequently, the technologies imposed by Lnu depict also the central group of digital technologies which have been brought up by the participants during the data collection.

The following five digital technologies from Table 4-1 depict the main set of digital technologies that are used by the teachers and were the focus of discussion throughout the interviews and the focus group. The table provides a short description of the technology which derive from the data collection. The digital technologies marked with an asterisk (*) represent the official digital technologies supported by the educational technologists. They provide pedagogical support and training for the teachers. All five technologies are furthermore supported on a technical level by the IT department.

<table>
<thead>
<tr>
<th>Digital technology</th>
<th>Short Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moodle*</td>
<td>A learning management system which provides a broad variety of functionalities which enables teachers to: organize courses; deliver tasks, assignments and documents, communicate with students e.g. via news and online forums, collaborate via e.g. Wikis and assess them e.g. with Quizzes</td>
</tr>
<tr>
<td>Adobe Connect*</td>
<td>A video conferencing software to hold online lectures and seminars</td>
</tr>
<tr>
<td>LnuPlay*</td>
<td>A video sharing platform to share recorded material (e.g. lectures) with the students</td>
</tr>
<tr>
<td>Skype</td>
<td>A video conferencing software to hold meetings</td>
</tr>
<tr>
<td>E-Mail</td>
<td>Is used to exchange electronic messages between teachers and students</td>
</tr>
<tr>
<td>TimeEdit</td>
<td>A scheduling system to book physical rooms for lectures or seminars</td>
</tr>
</tbody>
</table>

Table 4-1. Digital Technologies

In addition to these main digital technologies some of the teachers use and reported about a variety of minor technologies they use. They use additional technologies to promote more interaction in their education (e.g. with Padlet, an digital pin board or local software to record lections for LnuPlay or utilize ordinary office tools).

The digital technologies from Table 4-1 are digital technologies that are imposed by the university. This means that they depict a set of standard technologies (amongst others for this study irrelevant technologies) that all teachers at Lnu are asked to use in order to fulfill their educational duty. This implies on the one hand that the university can utilize the advantages of standardization by providing the infrastructure for the platforms, support and training, as well as the ability to create expertise around the use of the technology. Naturally, standardization also results into a certain lack of fulfilling unique needs.
The teachers are conscious about the fact that some technologies are imposed by the university. For example, participant 8 states:

"It is imposed by the Lnu to use Moodle. It is not my choice. I understand that we need to have unitary systems as it could be difficult if everybody would have different systems as far teaching is concerned. It is quite okay. I have no concern about why they have moved from Blackboard to Moodle. That is not a big issue for me." (P8)

The problem that comes with digital technologies that are not officially imposed by the university is that teachers and faculties are on their own when they experience problems as they cannot expect the educational technologists nor the IT helpdesk to provide support for external technologies. This can be justified with the condition that it is impossible for an IT department to have the expertise of the vast amount of available tools on the internet. One indication for this condition is that the educational technologist already perceives a lack of professional education for herself for the prevalent systems. Due to this lack, she often teaches these systems herself by applying an learning-by-doing approach and connects it autonomously to a pedagogical point of view, which she then can pass on to teachers. This suggests that the supporting instances are not able to support considerably more technologies than the official ones. One department experienced an initial lack of support when they made the decision to change from Adobe Connect to Skype.

Participant 7 explains:

"We had Adobe Connect for several years and some of us said that we should try Skype instead. The IT department was not very positive about us wanting to switch from Adobe Connect to Skype and they said that they can’t help us when we are changing. But then we decided to switch anyway because we were not satisfied with Adobe Connect.” (P7)

In the meantime between the transition to Skype and the time of this study, the university added Skype to the list of officially supported technologies at Lnu and therefore enabled the department a supported use of Skype.

Generally speaking this results in the dilemma that institutions or teachers need to evaluate the benefits of an unofficial tool (which may be tailored to the individual intended use) against the potential risks the use of unsupported tool holds e.g. in case of an error. In the above mentioned example, the decision to change to Skype was the right decision as no major issues were experienced and the support was established in hindsight. However, a negative example could be that the teaching process is interrupted by malfunctioning and unsupported technologies.

In retrospect to the officially supported digital technologies at Lnu from Table 4-1 the following subchapters are going to deal with these technologies. But first, a quick look on the technologies that are used the most is provided.

4.2.1 Most used technologies

Before presenting the different digital technologies in detail, it is interesting to have a look at the two digital technologies that the participants perceived as the most used ones. The analysis of the data shows that most teachers perceive that there are two technologies which can be considered the most used technologies. The rationale behind those two being Moodle and e-mail will be discussed hereinafter.
The understanding I got is that Moodle, as a learning management platform, has (to some extent) taken over the role of the traditional classroom. Teachers perform the majority of their communication via Moodle (see more detailed information about Moodle in chapter 4.2.2) which in return also leads to a certain dependence on the system. The fact that Moodle also is one of the technologies imposed by the university certainly supports that teachers perceive it as one of the major systems.

In terms of the ways how Moodle (as an example) is used, participant 6 describes her application of Moodle as follows:

“We have a Moodle classroom for every course and that is sort of what we have to have. I also try to use Moodle on a campus course and not, as some teachers, only like an information board. I do try to use the Moodle classroom a little bit more because I can actually put a lot of material there. You can do things on Moodle which are a good complement on what the students are doing in the classroom. So I definitely use Moodle the most because that is our tool.” (P6)

The other digital technology, which is used a lot among teachers, is the e-mail. According to my perception, the e-mail has been stated by teachers as one of the most used technologies because they use it every single day whereas other technologies such as TimeEdit or Skype are utilized possibly only a couple of times a week. It is important to note that this result needs to be regarded with a little bit of suspicion as the daily e-mail use consists, besides the e-mails for teaching, also a lot of mails that belong to research or are other external e-mails. It can be therefore not unambiguously stated that e-mail is really the most used one. What can be said is that teachers perceive the e-mail as a heavily used technology and is therefore included here.

4.2.2 Moodle

Moodle is an learning management system which takes in the role of the main communication channel of teachers at Lnu and creates an virtual classroom for students and teachers. The use of Moodle varies and the teachers can be arranged into two groups. Into the ones that perceive Moodle as a pure communication tool and others that see it as a pedagogical instrument.

Some of the teachers use Moodle solely to upload information and material for their students and to keep a rudimental contact to the students, e.g. to inform them about changes in their schedule. This group of teachers see Moodle purely as an communication tool and not as an pedagogical instrument which could also facilitate elements of an pedagogical strategy. This point of view on Moodle is described amongst others by participant 8 as follows:

“I think Moodle is the platform I use most. But I mean it is only in terms of communication. It is not a pedagogical instrument. It is a help instrument to communicate with the students. No more than that.” (P8)

The other, and technologically more advanced group of teachers perceive Moodle as an actual pedagogical instrument which is able to complement their teaching practices. They typically use the same communication functionalities as the basic users but try to utilize in addition some of the wide variety of functionalities Moodle provides. These functions can for example entail that teachers upload assignment tasks to the Moodle classroom and ask students to accomplish and then upload their assignments to the classroom for evaluation. Teachers can have synchronous discussions through the chat functionality with their students, or asynchronous discussions in discussion forums that
were created for that purpose. This enables the course to have discussions in an online setting similar to the traditional classroom. Others in turn prepare quizzes for students to e.g. examine them or to let them assess their current knowledge on their own. This contrary use of Moodle is explained by participant 2:

“Moodle is the primary tool for outer classroom communication with students. So I use it for posting preparation material, news concerning the structure of the course, resources that I mentioned during the lectures or uploading the PowerPoint slides. I use the discussion forums sometimes for group work because it is a very quick way for students to read each others submissions for a seminar. I use the assignment tool for most modules now because it is very convenient and the students can send submissions that are automatically checked for plagiarism.” (P2)

This shows that teachers perceive their needs concerning the digital technologies very differently which consequently has an impact on their actual usage. This different perception may be also an characteristic that will reflect itself in the teachers attitude and beliefs towards technologies.

However, besides these different opinions, the common ground among all participants regarding Moodle is that it is from the teachers perspective mainly used for one-to-many communication. Teachers argue that they want to keep all communication in a central place and visible for all students so that they do not need to answer questions multiple times. Concerning the use of Moodle as one-to-many communication tool, one teacher argues as follows:

„Well, the main function of Moodle is that everybody sees the conversations so I don’t have to get 500 questions.“ (P3)

This shows that the teachers after all share to some extent a common perception of the purpose of the learning management system Moodle and the difference lies only in how extensive they use the big amount of different functionalities.

4.2.3 Adobe Connect

Another widely used communication channel among teachers is the video conferencing technology Adobe Connect which is also used for one-to-many (or many-to-many) communication. Teachers use Adobe Connect to hold online live lectures and seminars. It enables the teacher to upload lecture slides that are shared among all participants. Adobe Connect is particularly a popular tool in distance education but can also be used in an e-learning setting when not all course elements are held on campus. Adobe Connect not only enables the teachers to broadcast lectures and seminar but also provides the opportunity to interact with the students. Students can exchange their ideas in an attached chat or can, similar to the traditional classroom, raise their hand to request the permission to talk which enables them to actively take part in the course.

Reflecting on the ability to interact with students and sharing lecture slides like in a traditional classroom makes it understandable that the majority of the teachers use Adobe Connect for one-to-many or many-to-many communication. However, Adobe Connect also hold the possibility to record the live online lectures so that the students (in particular the absent ones) have the opportunity to watch the lecture afterwards. It is furthermore used to pre-record lectures, so the students are able to watch the lectures at a time that suits them. Depending on what strategy the teachers apply this technology enables teachers and students to be independent from time and place.
As an example, Participant 6 describes her use of Adobe Connect as follows:

“I have worked a lot with Adobe Connect and I have recorded like hundreds of lectures in Adobe Connect. It is very easy to prepare a Power Point and just upload it to Adobe Connect and then record a lecture.” (P6)

However, the data shows that not all teachers use Adobe Connect on a regular basis in their education. Some state that they had only very few encounters with Adobe Connect and justify this with their focus on the campus education and their emphasis in the pedagogical strategy on face-to-face meetings. Nevertheless, some of these participants create ideas during the interview for applications in which they could make use of Adobe Connect. An example for this is Participant 8, who explains:

„Well, I have not used Adobe Connect. But I just remember that we have used Adobe Connect when one of my students was in Thailand for fieldwork and there were some examinations or seminars for which we used Adobe Connect, Skype or both in case the person was not in Sweden at this time. But I think I am going to use Adobe Connect to teach next term because I will be abroad and nobody else can teach my lectures. “ (P8)

Consequently, this shows that some teachers who base their education on the on-campus meetings and traditionally see their students face-to-face never felt a need to apply a video conferencing technology like Adobe Connect for their course. They do not seem to been confronted with that question often beforehand. My perception therefore is that the ideas some of the teacher mentioned were spontaneous ideas which were inspired by talking about Adobe Connect and the connected possibilities. A good example for this is Participant 4 who rather refuses the use of digital technologies as she advocates the personal contact. She explains:

„Adobe Connect has that possibility to record messages for the students. That would be actually a fun thing to do if I would know an easy way how to do it and if it would not require a lot of time from me. I probably would sometimes feel better to send a spoken message to students than a written message.” (P4)

Bringing more awareness to the possibilities of Adobe Connect can then also promote the use outside of the typical distance education setting and teachers can make an active and informed choice if this technology fits to the prevalent education strategy or if the strategy can even be adjusted.

4.2.4 Skype
Another digital technology that the analysis reveals is the video conferencing software Skype. The analysis of the interviews shows that Skype is mostly used for individual supervision or tutoring for students. However, some also use Skype for conference calls in small groups (for example for seminars). Participants state that Skype does not work very well with (big) groups as interaction is not perceived as easily obtained with it. The analysis shows that teachers that use Skype for group meetings do not exceed a group size of around 5 students. As an example, Participant 3 describes the use of his department:

“We only use Skype at the moment. When we want to have seminars through the web, or to start a new course I could send the lecture live through Skype and the students don’t have to come here to the campus.” (P3)

It is noticeable that participants stress that they use Skype preferably for one-to-one communication with students. It appears that this is connected to an advantage the
teachers refer to. They acknowledge that Skype is a tool which is easy to use and works without a lot of settings, functions and buttons. The lack of extensive functionalities as Adobe Connect provides them (such as raising the hand to speak) makes Skype less manageable and many students in one video conference can quickly cause confusion and disorder. Participant 5 explains:

“Our experience is that Adobe Connect works better with groups whereas Skype does not work with groups. It is just a hassle. And so we just use it one-to-one.” (P5)

The same line of thought can also be applied in reverse: Why do teachers prefer Skype for one-to-one communication over Adobe Connect. It seems that teachers perceive Skype as the easier software to use and do not want to hassle with the settings Adobe Connect provides and prefer the straight forward design of Skype. Skype has less buttons and functionalities and contains only the bare necessities teachers need for video calls with one student.

4.2.5 E-Mail

Continuing the line of thought with technologies that teachers prefer to use for one-to-one communication, the analysis shows that the e-mail can be classified in this category. Teachers use e-mail in order to keep in touch with their students and to inform them. A lot of one-to-one communication is done via e-mail in case the students want to ask the teacher questions outside of the classroom, the learning management system Moodle or the video conferencing system such as Adobe Connect. Participant 3 describes it as following in the interview:

“The e-mail system you might say is more for the case when the student wants to come in contact with me without any other of the other students know about it.” (P3)

The data from the interview shows that an considerable part of their daily teaching practices consists of using e-mail services by reading and responding to e-mails from students. As an extreme example, one teacher intentionally performs the majority of her communication through e-mail and asks the students to contact her via e-mail instead of using Moodle because, as she explains, prefers to instantly see when a student tries to get in touch with her. This teacher happens to use e-mail to an extensive amount. On the other hand, some teachers also try keep individual e-mails between the teacher and student to a minimum by encouraging students to use other forms of communication. Participant 5 for example states:

“We try to reduce the number of these individual mails, because we have these huge groups of 80 students and it is impossible to handle when all would write e-mails. So we rather encourage them to use the group forums in Moodle.” (P5)

Based on the reactions of the teachers while discussing their e-mail use, my perception is that the vast majority of the teachers are annoyed by the use of e-mail due to the fact that they receive a lot of email on a daily basis and a lot of time is spend to go through them. This seems also clearly to be the reason why e-mail is barely used for anything different than one-to-one communication and the reason why one-to-many communication has to large extent been moved towards alternative platforms such as Moodle. An important factor, which should not be dropped in this context, is that e-mail communication in the educational context also mixes up with correspondence that is unrelated to the education and therefore may deteriorate the experience even more.
4.2.6 TimeEdit

Based on the empirical material, the teachers also use the room booking system TimeEdit. Teachers use this digital technology to book courses for their lectures and seminars on campus. They use the system to check rooms upon availability and room size so that all registered students fit into the room.

Room bookings include certain information about the course, they are for example linked to the course and program codes (which are unique identifiers within Lnu) so that bookings are then also displayed in the student accounts. Furthermore, teachers have the option to add other teachers to the booking so that the course will be also be displayed in their calendars. Participant 1 explains:

"From my own perspective, when I want to book a room in TimeEdit I have to look for the availability of the date and of the room. So then I also need to know of course how many students are expected to be in my course which I can find out in Ladok. I then can add the other teachers to the course which can be practical because then it also appears in their calendar." (P1)

This digital technology depicts a tool that has a strong connection towards the administration but I believe that it is an crucial technology to plan the rest of the education accordingly. Although students do not have any direct educational or pedagogical value from TimeEdit, I perceive it still as an crucial part of the digital technology pervasion at the Lnu as it lays the foundation for the students in the form of a schedule by providing information about the major elements of their education, such as lectures and seminars. Therefore it is relevant to take TimeEdit in this study into account.

4.2.7 Future Ideas

The data shows that the teachers have ideas concerning the future-use of digital technologies in their education. For some of these visions they already know how to approach them and what digital technology to use, whereas others require technological advancement or additional technologies need to be acquired.

Ideas that teachers want to pursue in the future consist of the plan to incorporate the pedagogical concept of a flipped classroom in their teaching. The flipped classroom entails that activities that the traditional instruction of content (such as lectures) are moved into an online environment and the classroom time is instead used for interactive activities (such as discussions). Furthermore, the analysis of the data shows that some teachers want to increase their use of audible and audio-visual educational material as not all teachers have explored these possibilities yet. As an example, one participant states:

"I have never for instance worked with a podcast or integrated one a course. But this is of course something we can also do via LNUplay." (P5)

Furthermore, multiple participants have the desire for overall better integration among the technologies. A common complaint is furthermore that a good examination of students is not easy to accomplish over distance. This is in my understanding a coherent endeavor as examinations depict a fundamental part of higher education and also need to be performed in a feasible manner in distance education. As another example of a future need, participant 9 explains:

"Now we do the examination with ordinary written exams, because we don’t have this technique yet to make it on the computer. But it would be much better if we could
make it digitally and we would not have to send papers. So that is just a hopeful future that we will be able to do that.” (P9)

The data shows that future ideas, such as the improvement of integration of digital technologies result from downsides teachers experienced in the past. In order to not forestall the barriers, I will hereby refer to chapter 4.4 which will address these issues in greater detail.

4.3 Teachers attitudes towards teaching with technology

This section covers the attitudes the participants expressed towards teaching with digital technologies and is divided into two parts.

The first part of this section deals with the findings concerning the attitude of teachers in general terms towards technologies. Attitude here is understood as the teachers’ disposition and opinion towards the digital technology use in education. The limitation on general terms is used to exclude attitudes which are formed in relation to a particular digital technology. It is based on the assumption that teachers are able to possess a positive attitude towards digital technologies although negative experiences with digital technologies may were previously made.

The second part illustrates the findings concerning the attitudes and feelings of teachers towards particular digital technologies with which they encountered barriers and experienced downsides in the past. Instead of the general feelings, this part covers the feelings teachers associate to a certain technology.

4.3.1 General attitude

For the first part, the analysis shows that the majority of the participating teachers have an overall positive attitude towards digital technologies. This means that they are open-minded towards technologies in education and show willingness to deal with its possibilities. Nobody appeared to strictly refuse the use of technologies. They appreciate the opportunities that the use of digital technologies open up for their teaching as well as for their students. Teachers claim that it, for example, opens up the education to a broader audience and therefore enables students the education which they may could not have joined otherwise. Furthermore, it leads to a worldwide composition of students which for example can lead to have many different perspectives from distance and campus students in the classroom. This diversity in the classroom may result into more interesting discussions.

A precise description of these perceived benefits and the associated general positive attitude towards technologies is given by participant 5:

“The technologies have changed the quality of teaching and it has allowed more people to join higher education. People who would usually not have time because they have jobs like teachers or librarians or whatever. It is also interesting for us as teachers to have these students because they are much more experienced. They can contribute much more to class discussions. And what I have thought in the beginning was that it would be the end of civilization to not be able to teach face-to-face. That is something that is actually not the case. I am quite thrilled by these online students here and its really fun to teach online because they have so many different experiences. They are also many of them who work already in the industry in different ways and whereas the students here on campus in Växjö is a different audience. But it is cool, it is interesting to teach both versions. I like it.” (P5)
While the participant from this quote has a relatively neutral perception of the education quality change, the perceptions of the other teachers are quite diverse from another. However, the majority of the teachers argued that digital technologies generally improved the quality of teaching. Arguments are that quality comes along with the hands-on experience that teachers gain over time by using the technologies. Others have a pragmatic standpoint and explain that the ability to offer distance education by means of the digital technologies enable their faculty to afford and offer certain courses which may would not exist otherwise.

Even though there is a consensus among the majority of the participants that digital technologies have positive effects on the education, these results show that everyone has a different motivation why they share this opinion. The perception I got is that teachers value and view various aspects of technology differently. Some see it as a tool to get their daily business done and others see the opportunity to innovate their own teaching practices. It seems that teachers who see the technologies only as a tool for their daily business see positive aspects in the simplification and automation of certain tasks. It appears that teachers who see the technologies as a way to innovate their teaching are more eager to tryout new functionalities or technologies – for example adapting new ways of student participation or experimenting with alternative examination techniques. An example for this innovative mindset is the idea to produce a podcast and share it online with the students (see chapter 4.2.7).

Besides the positive views there are also teachers who have neutral standpoints concerning the general influence of technologies on the teaching. In the interviews, participants stated that they do not share the opinion that technology has an impact on their teaching quality because they see the content and not the medium as the important factor. Their perception is that the quality of teaching is solely defined by their teaching practices and not by any means by technology. For example, participant 4 elaborates on this, while still perceiving an overall positive attitude towards the technologies:

“I don’t think it has harmed the quality of the teaching, because I still do the exact same quality teaching as I did before. I think it has helped me, to get more information quicker to all students, to put responsibility to them, to inform them quickly about things they should be aware of. So, no I think it has definitely has helped me in the teaching. I just do not want to replace teaching by technology.”

(P4)

Notably on this statement is that the teacher has - beside the positive attitude – also a critical view on the digital technologies and its influence on future teaching. It shows that even teachers with a supportive attitude do not endorse the digital technologies unquestioned and without restraints.

Besides the general positive attitude towards digital technologies there are also negative comments concerning the digital technologies. The data shows that teachers do not have a use for all technologies nor for all the functions that the technologies provide. They feel no need for some of them as they do not match their subject or purpose. This leaves the teachers with a vast amount of possibilities which they need to look into and decide whether these functions are a viable option for their pedagogical strategy. At the same time there may be potential use cases where certain functionalities or technologies would be valuable for their education. The point of criticism by the teachers is that there seems to be a lack of interest in their actual needs. Two teachers in the focus group report about their vain endeavors to get certain functionalities for their courses.
Participant 9 elaborates:

“I try the technologies and then I see if they are useful. In many cases I don’t see them as useful. I can’t get what I want from them. So I stop using them.” (P9)

Another teacher states in the interview:

“No one asks the teacher what we want, they are not thinking like I am thinking. All I have are all kinds of nice tools that I don’t actually use because I don’t need them. There are a lot of thing on my Moodle that I don’t really use, because it doesn’t really fit to my subject.” (P6)

It is an interesting finding that this lack of involvement in the decision process leads to discontentment among the teachers and that they feel like someone who is not actively involved in the teaching activities is making the decision. It leaves them on the one hand with functionalities they have no use for and on the other with unmet needs and desires to design and plan the courses in the way they want. In retrospect to the previous chapter, which elaborates on the limited support abilities, it can be assumed that the resources are not sufficient to be responsive to all individual needs and to provide tailor-made functionalities. This, in hindsight, could be the reasons that some teachers develop negative feelings towards the general use of digital technologies in education.

Another kind of concern that is expressed during the interviews consisted of the personal attitude and belief in face to face discussions of traditional educational settings. This means teachers being not in favor of lectures, seminars and discussions that are solely held online. Participant 4 explains as following that the face-to-face contact is an important asset to her in education, she states:

“I am refrain pretty much from building groups and having them discuss as groups on the net, because I really want to part take or listen what they discuss. So I do some group work but I do it mainly with personal contact with them. So I am actually not using the internet as much as I could. That’s a personal choice because I do believe that I can help my students better when I can actually talk to them.” (P4)

The teachers holding on to these traditional forms of education do have in general some degree of aversion towards the digital technologies pervasion in our everyday life and society. It appears that this does not necessarily entail that teachers reject technologies in general. But rather that they are only willing to use technologies up to the extent that they perceive as necessary. It can be seen as an indication that the worldview of some teachers (or their attitude towards life) is the fundament for the principle to let technology only permeate their life to a certain extent.

Whilst these experiences from the teachers originate from their observations at Lnu, it is an interesting finding that also the digital technology use is seen in a broader context than just inside their own institution and the whole university. A few participants make comparisons to other institutions or to other universities in Sweden. As an example, one teacher made both of these comparisons. His attitude towards the own use of technologies was positive and he felt that his institution was ahead of others. He comments:

“They told us that we are using the technology more than others do in the other institutions. And I have learned that when I have been to meetings in Sweden with different universities that we are recording a lot stuff through Skype and send it to the students. And it is not often the case that other universities do that.” (P3)
In my point of view he was able to make this judgment as he seemed overall confident with using the technologies. In contrast to other universities his perception was that they are, at least to some extent, ahead of other universities.

The e-learning specialist puts this impression a bit better into perspective and states that the overall performance of the digital technology adoption at Lnu is on an average level in Sweden. His opinion is that the development of technology adoption at Lnu is heading into the right direction. Although it has still a lot of room for improvement. He illustrates it by stating:

“I think we are in a very average of place. We’re not terribly advanced, we have some advanced bits but in general I don’t think we do this particularly well yet. But steps are being taken, we are moving forward and there is more and more happening each year. Things are coming into place, so I am quite optimistic.” (P11)

Whilst both perceptions about the position of Lnu in Sweden are ultimately positive, it is important to note that the assessment by the e-learning specialist is a bit more conservative. It is likely that the perception of the e-learning specialist are more realistic due to big amount of experience he gathered over the years. The e-learning specialist made the impression to have a comprehensive understanding of the digital technology use at various universities in Sweden and abroad and therefore is a competent candidate to answer on this matter.

The positive note that the teachers at Lnu are generally moving into the right direction furthermore appears to depict an important signal for the teachers. It signalizes that the efforts they put into the digital technology use (including all the downsides) is recognized and appreciated.

4.3.2 Attitudes and Feelings
Although no one of the participants expressed that the use of digital technologies have generally a negative impact on the teaching quality, the interview data shows that there are nonetheless concerns about the current digital technologies that are in use at Lnu. Many of the concerns that were expressed by the participants are related to downsides of the respective digital technology. This means that teachers linked negative experiences directly to a certain system or some kind of function in the system. Nevertheless, they did not universalize these experiences to a general negative attitude towards educational digital technologies.

These specific issues and the experiences (or barriers) that teachers expressed (for example teachers receiving daily a too high amount of emails) are subject-matter of the following chapter 4.4. and will not be covered here.

However, when expressing their experiences with the digital technologies, the teachers also linked their feelings and emotions to experiences with certain digital technologies. These feelings also depict a major part of their experience because it enables teachers to see pure facts (e.g. bad sound quality) separately and disassociate them from their feelings. Furthermore, feelings and emotions are a good way to discover and detect attitudes related to certain technologies.

Therefore the focus of the following section lies on the attitudes, feelings and emotions which teachers experience when working with digital technologies rather than articulating the nature of the barriers they encounter.
The interviews reveal that the most common negative feelings towards technology are that teachers get emotional when something does not work how they intend. Most frequently emotions such as being annoyed, angry or frustrated were described by the participants. The data shows that teachers get annoyed, angry or frustrated because they rely on functioning systems and therefore expect them to work the way they are intended to work.

I believe that these negative emotions are primarily driven by the fact that teachers get hindered in their work. Possible consequences as getting slowed down, not being able to continue until it is fixed, or losing work progress to technical difficulties can be seen as main drivers to the discontentedness of teachers.

Further, it can be appraised that all teachers use the technologies to the best of their abilities. When teachers encounter problems, irrespective of it being their own fault or not, these emotional reactions are comprehensible. In many cases it can occur that the teacher does not know whether the system is faulty or if the problem was caused by their own mistake. In my point of view this uncertainty creates a feeling of having no control when the system inexplicably malfunctions. It further creates the perception of having no bearing on the technologies functionality. As a teacher that is aware of his or her lacking knowledge a problem may lead to a feeling of being overstrained with the technology and therefore leads to emotional reactions. Two participants illustrate their feelings. One describes:

“You get easily annoyed and angry because it should work. Technology should work and it shouldn’t be with all this difficulties. It is very annoying when you are supposed to rely on the system. “ (P1)

While participant 7 states:

“I don’t have any patience. I get actually quite frustrated easy when its not working. And that is probably related with that I am angry that I can’t understand why it is not working. “ (P7)

Teachers with limited knowledge about the digital technologies and without knowing how they exactly work can in addition lead to the discussed anger, annoyance and frustration also to insecurity and nervousness. The teachers are aware that they lack knowledge concerning some technologies and are therefore afraid to do something which they did not intent to do. As an example, a teacher may accidentally publish documents in the Moodle course too early or misconfigures examination functions (assignment uploads, quizzes, ...) in Moodle which may result into an unintended ad- or disadvantage for students.

It is understandable that this can lead teachers to be insecure about their technology-use. In particular because their actions or changes in the system may not be displayed explicitly and therefore may not be obvious for the teacher right away. This could lead teachers to discover their mistake when it is already too late.

These issues in turn provoke potential problems in the future when these mistakes are detected. It is then likely that the problems will be more complicated to solve or may even be irreversible. As an example, a teacher could publish information or documents too early or even to the wrong students. Furthermore, some participants explicitly describe being confused from time to time as they sometimes neither know how a
certain technology works nor why the system showed a certain behavior. The following quote are illustrative for this insecurity:

“So every time I have problems I am nervous about ’Did I do this right?’. I call the educational technologists and they assist me almost right away. It is good that you do have a question button in Moodle which you can press to get an explanation. But the explanation is not always sufficient. You still get pretty nervous that you didn’t understand it correctly and that you didn’t do it correctly.” (P3)

Similarly participant 7 describes:

“Actually the problem is related to the insecurity about how it works. For example what happens if I make the recorded lectures in LmuPlay public? Or what happens if I make the recordings personal or private?. There are different options all the time and maybe I didn’t actually realize what that meant.” (P7)

It appears that ’the fear of doing something wrong’ is holding teachers back to actively use the system. They are restrained in their use of the digital technology which consequently means that technologies are just used at a fraction and great potential is lost. The fact that some teachers remark a lack of trust in the technologies as they cannot rely on them confirms this perception. The danger this lack of trust entails is that it can be very difficult to regain this trust when they lose it completely and that it can be demotivating for the teachers.
4.4 Barriers in the use of technology

The interview data reveals that the teachers experience a variety of barriers that emerge from their technology use and hinder them in their education.

Amongst other things, one focus of this studies lies on finding out more about the barriers that teachers encounter. Therefore also the majority of the interview data resolves around this issue which results this section to be more extensive than the other ones. To provider a better overview, the barriers are structured as follows:

The barriers are classified into the following four different key categories: Cognitive limitations and other Challenges, Support and Training Issues, Technological Downsides, and Institutional Constraints (see Figure 4-2). These categories in turn contain the different barrier types which were identified in the data analysis. It is important to note that the different barriers and challenges are intertwined with each other and boundaries cannot be clearly defined. This chapters structure is illustrated in Figure 4-2 below.

**Figure 4-2. Barriers in technological use**

4.4.1 Challenges and Cognitive limitations

According to the data, the barriers that teachers encounter consist of a variety of challenges, such as the complexity, the tendency to forget or the lacking interaction. It is important to note that this section does not deal with technological downsides. The technological downsides, such as instabilities of the systems, are subject-matter to section 4.4.2. Instead, the focus of this section lies on the challenges in the design and structure of the systems. Further, the teachers workflow takes in a predominant role in this section. Other challenges, which this section will introduce and reflect upon, are the limitations of the teachers. These entail for example their cognitive skills or their limited knowledge of some systems.
Consequently, this first section and category is titled ‘Challenges and Cognitive limitations’ and presents and interprets the following barrier types: time consuming, complexity, tendency to forget, interaction, redundant and extra work and attitude issues.

**Time consuming**

According to the data, one of the biggest challenges that the teachers encounter with the digital technologies is that learning and handling the technologies is a very time consuming process. The teachers report that they often do not find the time beside their other teaching duties to properly learn how to use the wide range of technologies used in the daily business at Linu. In combination with the many other available technologies, which may be useful for their teaching, the teachers perceive the amount of technologies to learn as too big. Some teachers argue that it takes a lot of time to get used to these technologies by ‘learning by doing’ while other teachers criticize the lack of time to attend proper training.

Furthermore, they state that a lot of time is spend to keep up with the work which they already do with the digital technologies. This in fact can hinder them to fulfill their educational responsibilities. This lack of time prevents them to try out new or unused functionalities from the existing technologies or to try out completely new technologies. It in turn leaves teachers in a situation in which they decide to sticks to the principle ‘never change a running system’ as there is no time to experiment with alternatives. In addition, the issue is brought up that – when trying out new functionalities or technologies – it is uncertain if it even meets the requirements and may therefore not be the time-effort worth. The participants explained this barrier as follows:

"I just cannot go on a half-day seminar. That is impossible for me. If it would be a two hour thing I would probably go. But if it’s longer than that then I don’t really have the time for it between all the other things that I have to do. It feels like a little exaggerated." (P4)

Similarly, participant 9 refers to the time it takes to learn the systems and states:

"I would say time is the most limiting factor, because it takes time to learn new tools and then you don’t know if you need them or if they are useful or not. Because many of them are not really useful. So you have to try them out and then you can see if it’s something new you can use or not." (P9)

Participant 6 instead picks up the time related issues and describes her experiences concerning the course:

"Because we don’t have a lot of time, sometimes you just think ‘Okay, it worked last time I did this course, so I am just going to do it like that this year as well’." (P6)

Time is clearly an important resource for teachers and according to the data it is something they lack the most. Therefore it is crucial for teachers to minimize time consuming processes as much as possible so they are able to use the time for their core tasks as a teacher, such as preparing, holding and following up with lectures, or grading student essays. It is furthermore important that training courses are designed to fit into the tight schedule of a teacher so they are able to attend and improve their knowledge. This is hard to achieve as it is to some extent a vicious circle because many teachers need training to use technologies efficiently and on the other hand do not find the time to acquire these skills. Consequently ways need to be found to properly educate teachers and also to make technologies easier and more intuitive to use.
**Complexity**

In addition to the lack of time to learn and use the systems, the data shows that the systems are too complex for many of the teachers. Some teachers commented that there are too many functions and settings available in the different systems. This leads to confusion among teachers as they have trouble to remember the big variety of available options. This in fact is intertwined with the very next barrier and the teachers tendency to forget.

Furthermore, besides the systems being too complex, the data shows that the teachers need to know and need to handle too many different systems. It is argued that their environment of different technologies is getting too messy. Further, the current condition of the systems regarding the inconsistent look and feel plays as well a role. This complex situation is perceived by teachers as a maze. They have trouble navigating through it and teachers admit that they made mistakes in the past due to these issues. Some participants addressed the issue of complexity as follows:

"There are so many types of settings and many types of adjustments you can make in the functions. So there are a lot of choices to make when you fix a function. And I need to know about them so I don’t make a bad choice." (P3)

Participant 2 admits the mistakes he made due to the systems complexity. He states:

"I am becoming used to TimeEdit, although I’ve messed up booking rooms on it a few times. The problem with TimeEdit is its complexity. So you got similar choices, six or eight different interfaces on the very first page. Which I suggest is utter madness." (P2)

Whereas another participant explains the complexity with the changing layout and appearance of the different systems:

“I am on different kind of platforms and they are all different. And all have a different layout. And sometimes I just ask myself ‘Could’n’t they be a little bit more similar?’ But on the other hand that are sort of petty annoyances, so it’s not really a problem. But we do have a lot of systems that we do need to be familiar with.” (P6)

The problem of complexity is an important issue to address. The challenge of teachers to overcome the complexity is also intertwined with other challenges and directly influences them. The complexity can even be seen as one of the main reasons why teachers perceive the use of digital technologies as so time consuming and that they, as discussed subsequently, tend to forget how to use them. Complex systems are further likely to decrease the efficiency of teachers and may even affect the overall acceptance of the technology. Systems that are too troublesome to use will not gain a lot of popularity among teachers and teachers might decide to avoid them.

**Tendency to forget**

A common problem among the teachers is also that they tend to forget how to do certain actions or how to achieve a specific goal with the technology. This is a problem especially when functionalities are only used during certain times of the year or when they are used infrequently. Certainly it also depicts a problem when there lies a lot of time between the training of a technology and its first application. Due to the fact that they do not use some of the technologies (or functions) regularly enough, they are not able to cognitively develop a routine. The previously discussed complexity of the technologies of course also plays a prominent role to that problem.
Participant 7 for example makes a connection to her age, she says:

"I am not really sure that I am ready to take the job that is needed. It is difficult to learn about this when you become older. I can learn it, but then it goes two month and then I ask myself ‘Ah, how was it again?’. I don’t use it every day so it doesn’t become routine." (P7)

Similarly participant 2 states:

“It is probably three months later that I used the function again. And you had to go through remembering all this. The problem of the complexity is that it also destroys memory.” (P2)

While another one refers to the infrequent use of some functions:

"The problem is when I don’t use it frequently then I tend to forget." (P1)

This challenge for teachers evidently depicts a big problem for teachers as it hold them back with their education when they need to start again to familiarize themselves with how the digital technologies work. It further holds the danger to advocate negative attitudes, such as frustration or annoyance, towards the technologies. When teachers realize their lacking knowledge towards a system they may decide to not use this particular digital technologies or decide to use them less regularly.

Limited Interaction

One of the biggest issues the teachers address is the insufficient ability of technologies to enable interactions and discussions between teachers and students. The data shows that especially courses, of which the majority is held online, experience problems with the interaction. This is naturally not a big surprise as participants from these courses have no opportunity for any real life face-to-face discussion.

It was stated in the interviews that particularly discussions and interactions in bigger groups are problematic. These problems are for example caused by technical issues, students not having the right equipment, or by the increased hurdle to participate as students are not used to discuss virtually. One participant further expresses that her role in a virtual discussion changes too as she has to be more involved in the discussions and operate as a moderator in order for it to work. One participant describes their impression the following way:

"Having a discussion in real time is fine with up to four or five students. It has been my experience that it won’t work when I have 10 or 15 students. Something will happen. It might be a student who refuses to use a headset and all of the sudden we have feedback and no one can hear anything. Or it will be difficult for students to participate in the discussion. I don’t know if the problem is Adobe Connect or if it’s just difficult to have discussions online in real time when you are more than 4 or 5 people." (P6)

Likewise participant 7 advocates face-to-face contact by stating:

"I think to meet in person is always better. I still think that. It is still easier to have a good seminar face-to-face. But I think now that you can have a good seminar even when it is web based. But you can’t be so spontaneous. You need to have a clear assignment and you need to be in a seminar like a moderator." (P7)

This means that apart from the technical issues, for example the lack of facial expressions, gestures or the body language is a reason why it is a challenge to hold these virtual discussions. The limited interaction makes it harder for teachers and students to
exactly interpret what the other one meant with his/her words. Especially intricacies such as irony or sarcasm are hard to identify without seeing the persons body language. With the absence of physical proximity it is also difficult for all participants to establish a relationship to each other as you often only read, hear and maybe see the person via a webcam. Another barrier for interaction and discussions in a virtual space can be the delayed response, even it being just some milliseconds. These are some of the aspects why some teachers prefer to have these interactions and discussion in person and face-to-face rather than having them via digital technologies.

Besides the aforementioned unsatisfactory interaction, the teachers make clear that they want to have that interaction with their students. Therefore the complete absence of interaction is for example also criticized when pre-recording lectures. In this form of a knowledge transfer all interaction will be absent. The participant argues:

"If the students listen to a recorded lecture there is no interaction at all. But if I have the lecture in the classroom the students will ask questions and they will discuss things and it is much more interactive" (P6)

Due to the fact that interaction among teachers and students is seen by the participants as an essential element of education the lack of interaction is an important issue to address. Teachers struggle to keep up with the level of interaction they are used to and miss the personal component of the traditional classroom, which they cannot substitute with technology that is perceived as a barrier between them and the students.

**Redundant and additional work**

Another challenge the teachers perceive is that they either do redundant work or unnecessary additional work. This is an issue as it hinders teachers and holds them back to do more important tasks. Therefore, this issue is also somewhat connected to the challenge that the technologies are time consuming.

According to the data an example issue emerges with the room scheduling system TimeEdit. Some teachers report on issues with booking rooms for their lectures or seminars. Even though the system displays a room as available at the time of the booking it appears to happen that booked rooms are canceled by an administrator with the justification that the room is already booked. The problem with redundant work occurs in this case when the teacher either has to redo the whole booking again or to bespeak a room by the administrator. As the cancelation of the room does not appear immediately, the teacher also has to adjust other steps that are connected to the room booking. This could be, for instance, that announcements to students need to be corrected. As participant 4 describes:

“If I book the room in TimeEdit it is quite often that I get a message from the administration that the room is taken and that I need to be rebooked to another room. So I cannot really see when the room is taken. For me its kind of like double work because then I have to rearrange for another room and everything that comes with it.” (P4)

Another example for redundant work described by the participants is the grade registration of students. Assignments completed and uploaded by students to Moodle need to be graded by the teachers and these grades are often registered to Moodle. This is optional for the teachers but the interviews show that the majority of the participants provide students their grades via Moodle. It may be the case that faculties apply different policies about entering it in Moodle or not. However, besides Moodle, the
grades also need to be added to the administrative system named Ladok which is used to record the student results. The use of this system is mandatory for all universities in Sweden. As a consequence, this means that when teachers choose to make the grades available via Moodle, they have to enter them into two different systems – resulting again into redundant work. This in turn is associated with the issue of technologies being too time-consuming as it can be a tedious task to enter grade for grade into the system and double checking them so no mistakes are made. This is criticized by a participant as follows:

“The compatibility between Ladok and my Moodle is something that should be there. I have never detected any university which is able to have grades reported back through my Moodle and into Ladok at the same time. Just before you came here for the interview I was downstairs with a piece of paper with the grades on it which I signed. It is not a good example of compatibility. It is triple work, because I’ve got my records first.” (P2)

Contrary to this form of redundant work, caused by insufficiently designed systems, there is also a different perspective on this issue. The criticism comprises that many teachers perform the exact same tasks (e.g. any kind of instructions concerning assignments, projects, …) each for themselves and therefore invent the wheel over and over again. This form of redundant work is according to one teacher occurring due to the lack of a central technology which enables teachers to openly share their work with each other so that it can be re-used. One participant states:

"We are doing unnecessary things. A lot of teachers do the same things and everybody is sitting in their own room and doing identical tasks. I think maybe the university should have something that was more for everyone to use. It could be like an open library. That you could get things from there about for example ‘How do you write a good essay?’ or something like that. I know the library have some of these and that is good I think.” (P7)

The fact that many of the participants perceive that they do unnecessary redundant or additional work is an interesting finding as this in turn means that a lot of valuable work time of teachers is used without getting any real value out of their work. This in return can possibly effect the attitude of teachers as it can be frustrating when you are working on something for nothing. Above all is this directly connected to the previously discussed problem of too time consuming processes as redundant work wastes a lot of the time teachers have available.

**Attitude Issues**

The e-learning specialist claims that the barriers do not origin from the technical side but are rather attitude problems. Traditions of people or institutions play a major role in this problem and hinders the change that is needed to achieve comprehensive evolvement in the use of digital technologies in education. He explains:

“The problems are in the heads of the people. They are not technical problems, they are attitude problems. They are problems about tradition. It is a very very strong factor. And tradition in higher education is one of the biggest barriers to change that exists. I am not against tradition, traditions are great. But this traditions ‘We don’t do that sort of thing and that is the end of the end of the discussion’, isn’t terribly scientific. The system is stacked in favor of continuing doing the same old thing we’ve always done.” (P11)

On the other hand, the interview data does not show concrete signs of general disapproval against the digital technology from any of the interview data. It can be
found that only one teacher makes an argument in that direction. She prefers the personal contact with the students and those to do so if possible. Nevertheless is she using the digital technologies to the extent she is comfortable with and where she believes it is beneficial for her teaching. She argues:

“I am actually not using the internet as much as I could, and that’s a personal choice. I do believe that I can help my students better when I actually talk to them.” (P4)

Due to the fact that the data has not shown significant signs that teachers favor traditions over innovative digital technology use, the statement by the e-learning specialist should be addressed cautiously. Not least as it can be interpreted as rather provocative.

Nevertheless is this a very interesting finding as this statement allows to assess the situation from a different perspective. It shows that reasons for no satisfying use of digital technologies cannot only hold technological deficiencies accountable but also should take the people which work with the technologies into account. Taking a look on a different stance of the issues therefore is good as it enables to relativized the statements by the teachers. It is important to keep in mind that some issues may be able to be approached from multiple sides – from a technological side by fixing downsides as well as making a bigger effort to educate teachers about the possibility and benefits from digital technologies.

4.4.2 Technological Downsides

Many challenges the participants report about are downsides they experience with the technologies. The biggest technological downside the participants report are the instabilities and malfunctions of Adobe Connect. The data shows that most participants that use or have applied Adobe Connect in their teaching have experienced similar problems with it. The biggest problems the teachers face are problems with the sound. The most common and most disruptive problems are the bad audio quality and acoustic feedback. They furthermore experience bad quality from the webcam broadcast. The former even was the determining factor for one institution to replace Adobe Connect with Skype. For example, one participants states:

"Sound and picture quality I would say was the biggest problem. To have direct communication you need a really good picture and sound." (P9)

According to the educational technologists the bad quality can often be traced back to the bad internet connection, which is usually caused by the utilization of wireless connection by the teachers. Interestingly, other teachers further argue that not all rooms are equipped identically and sometimes do not hold the possibility to have a wired connection. Furthermore, wired connections do not always solve the issue of bad sound and video quality.

The educational technologists states:

“The problem is always the sound I think. And the sound depends on what connection you have. If it is a wireless connection it is not a stable connection. Most of our teachers have their own laptop with them, so they connect with the wireless connection and that is not a good connection. So if you want to be sure that you will have a good connection it should be on the network with a cable.” (P10)
And a teacher argues:

“I have learned that Adobe Connect does not work well on wireless connections. So you need to have the cable. But if I go to a room which is not here at this institution then I cannot connect to a cable because they have limited outlets where we can connect.” (P1)

The problems with the bad quality in Adobe Connect and the known workaround is a very interesting finding as on the one hand not all teachers seem to be aware that a majority of the problems they experience may be solved by connecting a cable to the network. On the other hand it seems like the educational technologists may not be aware of the issue that not all rooms hold the possibility to use a wired connection.

Furthermore, it is noticeable that many teachers, especially the ones with distance courses, are afflicted with the Adobe Connect issues and that connecting a network cable is no satisfying solution to the problem. It holds the teachers and students back as technical problems disrupt and delay the content and knowledge delivery. It seems that many participants working in distance education do not seem to have an appropriate alternative to Adobe Connect whilst still being affected by the problems on a daily basis. Although one institution reports about the successful switch to Skype, participants of other faculties report that Skype does not fit their requirements due to the bigger amount of students in the courses. This is due to the bigger course sizes which makes the interaction (as explained above) harder.

Besides the issues with Adobe Connect, there is according to the data a lack of integration of different digital technologies which depicts a challenge for the teachers. As it has been already mentioned in the section above, concerning the redundant and extra work, there is a lack of integration between Moodle and Ladok. The issue is that teachers need to enter grades for assignments in Moodle (as feedback visible for students) and they additionally need to report them to the administration so the administration is able to enter them in turn into the grading system Ladok. As previously discussed, this lacking integration of these two system leads to redundant work for the teachers and even depicts a higher risk of wrong grades being entered as teachers need to enter them into the system multiple times and may not be able to double check them every time.

Other examples for the lacking integration is observed with Moodle in connection with other systems, such as Adobe Connect or TimeEdit. It is criticized that Moodle does not have an option to automatically connect and display an corresponding Adobe Connect room or TimeEdit schedule to the Moodle user interface. In the current state course administrators need to manually add a link to the Moodle course room page if they want students to have an easy access to the video conferencing system or their schedule. They wish for a similar level of integration like with LnuPlay which makes it possible for teachers to directly embed video files from that platform. Participant 2 discusses about the need for an integration of Moodle and Ladok:

"Compatibility between Ladok and Moodle is something that should be there and I have never detected any university in being able to have grades reported back through Moodle and into Ladok at the same time." (P2)

The most interesting part of the findings concerning the lack of integration is that their wishes are all connected to Moodle. It discloses that teachers see Moodle as their main communication tool and as a hub which enables them to direct students to other
services, but that they desire more sophisticated possibilities to do so. It is an indicator that it is important for teachers to a certain degree of convenience when using digital technologies in their education. It further shows that Moodle has still a great potential and many ways in which it is able to improve in the future and to enable a frictionless use in education.

4.4.3 Support & Training Issues

The data shows that the university provides two types of support: In the first place there is the IT helpdesk which provides purely technical support in case of software bugs or hardware failures, and secondly every faculty employs one or more educational technologists (also referred to as ICT pedagogues). These educational technologists are available for all sorts of question in regards to the (officially supported) technologies concerning, for example the handling of those or the support for pedagogical use of the digital technologies.

All interviewed teachers report that they have made use of at least one of these two support instances. Most of them even utilized the services of both and surprisingly many of the participants tell that they contact them on a regular basis. The general impression among the teachers is positive and both support instances are perceived as helpful and friendly. It is argued that the educational technologists are very knowledgeable about the possibilities and handling of digital technologies. One teacher describes his impression like that:

"The IT helpdesk is great. I mean really great. They're responsive, they are a nice mix of people, they know what they are talking about and they having a depth of specialism that they can refer to on beyond that." (P2)

Along the way participant 3 complies with the positive impression and states:

"We are very lucky to have these two educational technologists supporting us." (P3)

However, besides the praise for IT helpdesk and educational technologists, the participants also express criticism. The major criticism is that the teachers perceive the lack of pedagogical support. The teachers desire some form of pedagogical support which helps them to use digital technologies in the best pedagogical way. This means that the possibilities of digital technologies need to be connected to pedagogical principles and ways how to use the technologies in the respective courses need to be disclosed. The data shows that there cannot be one-size-fits-all solutions, but the use of digital technologies rather need to be custom-designed to fit to the respective course of the teacher. This is due to the circumstance that every course is different in terms of e.g. subject, level, students or course mode (distance, on-campus, …) and therefore needs to meet particular requirements. The criticism is formulated as follows:

"My anonymous blunt perception is the ICT pedagogues are not quite as professional as the IT helpdesk. They're very very good on particular things. Their knowledge is accessible. I had for example someone showing me for about an hour how to use the assignment tool effectively. And that was a very good hour for the institutions point of view. And from mine." (P2)

In the focus group one participant articulates the problem she sees more clearly:

"I think our ICT pedagogues are not pedagogues. They don't know pedagogy. They know something about the systems, but most of the times I know more. The ICT pedagogues need to know something about the courses, because you can't do exactly
the same for all courses. We need to sit and discuss what will happen and if we do things like that, and what will happen if we do them like this?“ (PE)

It is furthermore an interesting finding that the level of support by the educational technologists is unequally distributed among the different faculties. It is reported that some of them are proactively seeking the contact with the teachers and organize various occasions in order to inform the teachers about the possibilities and how to adapt them in their teaching (e.g. small seminars during lunchtime), while some teachers only get in contact with the educational technologists if there is a problem and support is necessary. An indication for the unbalanced support is given by participant 3, who states:

"We are pretty blessed to have those two educational technologists here. As I have learned we have a lot of support here compared to other institutions at Lnu. They hold lectures for us during the lunch once a month. So we have a lot of support. And this day-to-day basis support is highly valuable." (P3)

On the other hand and an unexpected finding is that a few teachers do not even know about the existence of educational technologists (or ICT pedagogues) at their faculty or, if they know about it they are not aware who occupies this role. Interestingly it turns out that the interviewed educational technologist is aware of these problems concerning the limited pedagogical focus, the lack of unitary level of support and limited knowledge about existence of educational technologists. Additionally, the educational technologist reports that many teachers do not exactly know what this role entails and consequently are not aware about the possible types of support. This in turn means that questions often do not surpass a very basic level. It is furthermore problematic for them to penetrate into the structures of the faculties and establish a closer partnership between the teachers and educational technologists in order to facilitate, support and encourage the use of digital technologies. For example, one participant of the focus group states:

“Can I make a confession? I did not know that there was a position called ICT pedagogue. Who is that person?” (PC)

Similarly participant 4 says:

"I used to contact the ICT pedagogues more but I now don’t even know who that even is." (P4)

Correspondingly, the educational technologists illustrates these issues from her perspective as follows:

“I think we teach the technologies not in a pedagogical point of view and only explain how they can use it. But I think we will get better in that way, and now since we and the teachers have three or four years experience I think now there are other question around. Because the teachers are more familiar with the system and now they want to do more. [...] My level of support also depends on if they know my role as an educational technologist. They need to see how they can be a part in the distance learning, so then they can come with questions about the pedagogical point of view and how we can make the distance learning better. And also what other programs they could use to do their teaching better in e-learning. But some people don’t know what I really do. [...] It is difficult to get into this institutions. Because every institution or department is on their own, they have their own boss. You can say that they have their own organization. So we try to invite ourselves to the institutions.” (P10)

The quote shows that the educational technologist seems to be well aware of the situation and its challenges. She provides a glance into the future and contemplates
somewhat about how the support, and more importantly the cooperation between educational technologist and teacher, can improve. It appears that the educational technologist justifies the current state of the support and digital technology-use in education with the young age of the university. Many organizational structures have changed since the university emerged out of two not interdependent universities. The educational technologist states that a basic understanding has been developed now which enables the university to develop and establish a better pedagogical foundation for future digital technology in cooperation with the teachers.

4.4.4 Institutional Constraints

Another challenge for teachers are institutional constraints which limit the ability of teachers to perform certain actions. These limitations are imposed by the institution (the university) and are thus institutional constraints.

The biggest institutional constraint revealed by the data is the limited authority of teachers in the systems. The majority of teachers experience this lack of authority when trying to book lecture or seminar rooms in the room booking system TimeEdit. The issue they come across is that it is restricted which rooms they are allowed to book. It appears that only rooms which belong to the pool of the faculty seem to allow trouble-free bookings. Teachers have found workarounds to this issue and ask the faculty administration instead to perform the room booking for them. However, this means in return that the teachers are due to the lack of authorization not able to apply any changes to these bookings carried out by the administration. This again depicts a barrier for teachers as it is not uncommon that e.g. the time or the room of a booking needs to be changed. As a result, teachers need to make a detour via the administration again.

This has especially been a problem to the teachers in relation to the room booking system TimeEdit as they experience problems booking lecture or seminar rooms. The issue is that they have limited authorization which in turn means that many of the available rooms are not bookable for them. Only rooms that belong to the pool of the faculty seem to be bookable without troubles.

Workarounds to this issue have been found and teachers tend to ask the faculty administration instead in order to perform the room booking for them. However, this in return means that the teachers are not able to apply any changes to these bookings as they still lack the authorization. The findings show that changes of room bookings are not uncommon as the time or the room needs to be changed. As a result teachers have to make a detour via the administration again. The Participant 1 describes:

"There are different levels of authorities. You can be different kind of users and I am a normal user. You can have some kind of super user which gives you bigger possibilities." (P1)

Whereas another teacher describes her workarounds regarding TimeEdit:

"That’s a tricky part because I can do it in two ways. Either I can send a schedule to the administrator in the faculty and she will put everything in but then I can’t change anything myself. If I want to change something I must go to this administrator and she has full access in TimeEdit. So it is quite easy for her to put everything in. Or I can put it in myself, but the web interface is much more limited and its quite time consuming to put it in if you have a schedule with a lot of bookings" (P9)
The same criticism has been brought up in the focus group. Participant B for example says:

“*But the room booking has become such stupid process. Because of the troubles of using these systems, our administrative personal has given us an excel file. So we do all the planning of the rooms in the excel file, send it to them which they enter in the system. And then it becomes so stupid, then we want to do a change and as you [one of the other participants] said, we have to call them. And every time we call them they are not there, they are in a meeting, we have to wait, we want to change that text.*” (PB)

While another teacher understands the administrative reason behind this problem and states that the administration may want to prevent mistakenly booked rooms. He states:

“*Haven’t you been in the classroom that somebody reserved the classroom for the whole semester but forget that the course is canceled? So I see the other part of it as well.*” (PC)

Besides the lack of authorization, the data shows that the teachers think that some of their requirements are not fulfilled and that nobody asks them what kind of technologies or functions they really need for their teaching or what kind of educational program they pursue. The teachers for example argued:

“*It has been decided that we should use Adobe Connect *” (P1)

One teacher states that he understands that there needs to be a certain standard in place:

“*It is imposed by the Lnu to use Moodle, it isn’t my choice. Ok, so I understand we have to unitary system. If everybody has different systems it could be difficult as far teaching is concerned. I have no concern about why they have moved from Blackboard [the previous LMS] to Moodle.*” (P8)

This shows that teachers are somewhat left with the decisions others made concerning the choice of technology or granted authorization in the system without being informed about the reasoning behind these decisions.

These institutional constraints are also brought up by the e-learning specialist. However, he approaches with his criticism from an much more abstract point of view. He criticizes that there is no top-level regulating body on a national level which could impose things (such as overall structures, policies or strategies) concerning digitalizing the educational environment down to the level of universities, its institutions and teachers. Due to this lack, according to the e-learning specialist, a lot of the responsibilities are imposed on the teacher himself or herself who is not able to bear this challenge alone. He states:

“*Unfortunately, Sweden is rather unusual in the world and that this question [how digital technologies can facilitate education] doesn’t exist on top-level. There is no government agency or ministry that owns this problem. The use of the digitalization in universities doesn’t exist at the top. […] So there is no national structure or strategy for digitalizing universities in Sweden. […] Its all delegated to each university, who delegates it down to the faculty, who delegates it down to the institution, who delegates it down to the teacher. […] And we tend to reinvent the wheel all over the place.*” (P11)
Therefore, it is also brought up by the e-learning specialist that there are so far no strategies in place for distance education at Lnu. He states:

“But isn’t it fantastic that we’ve been working with distance education in Kalmar since 1992, in Växjö also almost as long. And we never had any quality system or guidelines or strategy what’s-о-ever. Everyone just does what they think. And that’s not untypical, I’m not complaining about it. That’s the way that everyone has gone. Now we are seeing the need to put all together and an assigned university employee and many others are trying now to put that sort of overview together.” (P11)

The view from the e-learning specialist enables us to view the digital technology use and its barriers from a different perspective than just the teachers perspective. It shows that not only teachers, faculties or the university can be blamed for the current situation of deficiencies with the digital technologies. Responsibilities were handed down to the last entity in the education chain which happens to be the teachers.

### 4.5 Strategies to circumvent barriers

The preceding section discussed a huge variety of existing barriers and challenges that teachers have to cope with on a regular basis. Over the time they have found own ways on how to handle some of these issues, in order to be able to continue with their education. A selection of the most prominent strategies will be discussed in this section.

The most common strategy by teachers is to apply workarounds to be able to achieve either the same or a similar result of their desired goal. Some examples for workarounds applied by the teachers will be given in the following abstracts. Participant 9 argues about the use of workarounds as follows:

"Yeah its always possible to handle the problems. Work around them I would say. I would say everything works to some level satisfactory." (P9)

As it has been discussed previously, many teachers see big groups in distance education as problematic. Issues are e.g. the limited interaction or technical problems with at least one student in seminars with big groups. An example for a workaround in this case is to split the big group into multiple smaller groups. This enables teachers and students to have an easier interaction with each other as less people cause less disorder. Furthermore, students may be more likely to speak out when they are in a smaller group which also reduces the barrier for reserved students to contribute to the discussion.

The second workaround is related to the bad sound and picture quality teachers experience with Adobe Connect. As this leads to many problems in distance education, teachers likewise had to find ways to deliver their seminars or lectures in a satisfying level of quality. An alternative chosen by a department was the switch to the digital technology called Skype. This allowed them to provide seminars and lectures to a quality level in conformity with their vision. The data shows that this depicts a workaround to their satisfaction.

The following example of a workaround is related to the lack of integration of Ladok and Moodle. To briefly recall, the issue is that teachers face redundant work as they have to report grades from students into the two different systems. The grades that need to be registered in the central grading system Ladok is governed by the administration and teachers need to provide the grades in a list which has a certain format. As this depicts an time consuming process, the most sophisticated workaround is from a teacher who figured out a workaround for himself by means of Microsoft Excel. It helps him to
automatically import data from Moodle to generate the list for the administration rather than doing everything manually.

The fourth and last example of a workaround that teachers came up with refers to the lacking authorization of the room booking system. Due to the issue that teachers are confronted regularly with unbookable rooms in the system, many of them contact, instead of using TimeEdit, the administration and ask them to perform (or edit) the room booking for them.

Following are some examples how participants described their ways of handling the challenges. First off, one teacher describes her way of handling big groups in distance education:

"When there are fifteen students I usually like to split them up into three different groups. Then I pick three different times of the day and we discuss the same issue in each group. I have to do that multiple times because I tried doing it in bigger groups but that was not so good." (P7)

The choice by one department to switch to another technology is argued as follows:

"We ended up in Skype for business instead, because its more easy to use. The students don’t have to go through a whole lot of steps to get acquainted with the system. The system works so much better than Adobe Connect. So we use Skype instead because of the higher quality when talking to students. “ (P3)

And eventually participant 1 passes on the task of booking a room and states:

"I just send the list with the course information and schedule to the administrator in Kalmar and ask them to do the booking." (P1)

Another strategy to circumvent barriers, apart from working around them, is to avoid their use. Whilst some of the prior examples already imply the avoidance of a particular technology (such as avoiding Adobe Connect by switching to Skype or avoiding TimeEdit by asking the administration to do the booking) there are also other examples of teachers avoiding technologies. It is to note that the subsequent examples are different from the previous ones, because the hereinafter mentioned examples do not refer to the use of a immediate substitute technology. Consequently, avoidance means in this context that teachers decided to not use the technology or an alternative technology. Due to lack of experience and confidence one teacher avoids the use of LnuPlay, another one avoids the use of many of the additional tools and a third one avoids digital technologies when she encounters problems. That teachers avoid some technologies is illustrated by the following quotes below:

"We only just started to use LnuPlay and I want to use it to do interviews. But I am not confident at all with it. So I have avoided LnuPlay so far in general." (P5)

This is similarly illustrated by participant 6:

" I sort of ended up not using a lot of the additional tools anyway. So I am sticking with what we have." (P6)

And a third participant rounds the fact that technologies are avoided off by stating:

"Sometimes if I cannot handle the problems I do it the old fashioned way. “ (P4)

The third and last strategy the data identified is that teachers limit their use of the digital technologies to the extent they are capable to use and use them only to the extent that is needed. They restrain from putting extra efforts in the teaching with technology. Some
teachers stick to the proven best practices which they are familiar with and aim to achieve their goal with the technological knowledge they possess. This “path of least resistance” does not always seem to be generally applied to all digital technologies but individuals rather apply it to one specific technology (e.g. Moodle). The participants explain it like this:

"Actually, maybe I do the easiest way there. I think. If there aren’t any good options I just take something that I am able to do. I don’t actually look for new functionalities there." (P7)

Likewise participant 8 admits to use Moodle only to a certain extend:

“I maybe do not use all the capacity of Moodle. But for the utility I have for Moodle it is enough for me to achieve the goal with this kind of technology.” (P8)

Similarly another participant states:

"Probably I am just using the functions I know and that I am comfy with." (P5)

All these strategies do have the same drawback – the use of digital technologies is only performed to a certain degree of satisfaction. This means that further development is held back and teachers do not evolve in their teaching activities. The evolvement is held back as some teachers then do not strive to exceed with their technology-use their own level of satisfaction when they encounter barriers. It can even be argued that the education is hindered when commonly used technologies are avoided because of their problems.

The workarounds are in that sense problematic as that they usually end up in more work for the teacher. They need to put effort and time into establishing new strategies which are likely to be not as good as processes that the prevalent digital technologies provide – given that they work without difficulties. It is inefficient and expensive when teachers need to reorganize their working processes to a allegedly worse state. A good example for this is the teacher who splits big groups up into multiple smaller groups. It means in turn that the teacher has to deliver the same content multiple times, which depicts a considerable time effort for the teacher. On a different note, the case where a whole department switched from Adobe Connect to Skype also means in turn a loss of functionalities (such as a convenient way to share documents with all students or for students to virtually raising their hand to become speaking rights). All in all it is certainly positive that teachers find ways to achieve their goal, but nevertheless it is an issue that the university should address because regularly performed processes are altered, or teachers miss out on developing even better processes or methods.

This applies similarly to the avoidance as well as to the restricted use of digital technologies. As a matter of fact, avoidance can be considered as even worse than applying workarounds, as teachers (and consequently also students) miss out on the possibilities and potential that the digital technology use entails. Furthermore, any additional evolvement of courses are massively hindered when everything is done the same way as it has always been done.
5 Discussion

This chapter is going to discuss the different concepts that have been presented and analyzed in the previous chapter. First, the findings will be discussed in relation to the purpose and the research questions of this study and will reflect upon the findings of the literature review. It will point out unexpected results and discuss relations and dependencies among the findings. Subsequently the implications of the findings will be discussed.

The purpose of this study is to identify the digital technologies that teachers are using to fulfill their daily teaching activities and to investigate the problems that arise when using these technologies. The focus of the study lies on the barriers that teacher encounter on a day-to-day basis. Also, the teachers’ attitudes towards digital technologies are investigated and the strategies that teachers developed to deal with the barriers are detected.

5.1 Findings, previous research and relations

The findings of this study first of all show that they are very hard to distinctively review. Many of the findings are intertwined with each other and affect each other in one way or another.

This section is going to discuss the findings in relation to previous research as well as in relation to other findings. The section attempts to follow the outline of the empirical findings and therefore divides into the following three parts: Attitudes and Feelings, Barriers, and Strategies.

5.1.1 Attitudes and Feelings

The findings of this study show that the teachers, while staying critical, have a general positive attitude towards the digital technologies in education and agree that the technologies are being helpful. This is in line with the OECD (2010), which states that most teachers believe that digital technologies can be beneficial. Benefits that appear to be important for the participants of this study is first of all the ease of communication that it entails. For example, information can be sent out and is immediately available for all students. A further benefit that is highly valued depicts the possibility to make academic studies available for a broader and worldwide audience and therefore bring unheard perspectives to the classroom discussions.

Consequently, due to the general positive attitude, it leaves me with the question if the pedagogical beliefs influence the teachers opinion about the impact of technologies on the teaching quality. The findings of prior research from Tondeur et al. (2017), who see pedagogical beliefs as barriers to technology integration, suggest that a correlation seems reasonable. However, the findings of this study consist surprisingly only of little evidence that pedagogical beliefs depict a considerable barrier at Lnu. The reason for this perception may be due to the circumstance that only one teacher took a stand in regards to her pedagogical beliefs and her respective actions, stating that she is in favor of the traditional teaching style and desires the personal contact with her students. Apart from that one teacher only the interviewed e-learning specialist suggests pedagogical beliefs to become barriers in digital technology adoption, by pointing out his impression that many teachers prefer to stick to traditions and are not open for change.
These findings are also in contrast with Englund, Losofsson and Price (2017), who stated that experienced teachers are often resistant to change. Apart from these two statements above, there is no evidence that teachers are stuck with traditions. Teachers rather seem to be eager to use technologies to their advantage, but encounter multiple types of barriers (see chapter 5.1.2) to do so. Therefore, the finding by Englund, Losofsson and Price (2017) and the impression of the e-learning specialist should be viewed critically. A possible explanation for the rejection of new strategies for digital technology use can be justified in the excessive demand, which is caused by the variety of barriers. When the current strategies in place cannot even be carried out by the teachers in a reasonable way, it is to no surprise that potential innovations are met with refusal. In this context it can be questioned to what extent the potential strategy advancements should and can be carried by teachers, in order for them not being labeled as traditional teachers. Is the demanded change too big and teachers risk – metaphorically speaking – to trip over their own feet, it is to no surprise that teachers may be perceived as deprecative to new and innovative strategies for digital technology adoption. After all, I believe that change should be performed under the conditions of organic growth in order to be sustainable. When the present technology is permeated with barriers, I reckon that evolvement is considerably harder for the teachers as the executing individuals.

Besides the concern that traditions get in the way of digital technologies in education and the positive characteristics that are the reason behind the general positive attitude to the technologies, the teachers also pass other relevant criticism on which is relatable to their attitude. The criticism that the study reveals shows that teachers are not thoroughly happy with the present digital technologies and that they desire to exploit the full potential that digital technologies promise. This matches the thought of Flavin (2016), who argues that the institutions are missing out on their potential. Missing potential of institutions naturally affects eventually the respective teachers. Furthermore, one of the most interesting findings are the different negative emotions teachers have when facing digital technology issues. Strong emotions, such as anger, frustration or annoyance, turned out not to be an uncommon narration of how teachers feel in challenging situations. They further are insecure and nervous about doing something wrong in the systems, which confirms the findings of Tondeur et al. (2017), who state that some teachers feel a lack of control when handling with digital technologies. However, these negative emotions concerning technologies are usually directed towards a particular technologies and not technologies in general. These emotions towards particular technologies are triggered by the barriers that teachers experience in their daily business.

It can be assumed that the emotions also affect the teachers in their decision making process about which digital technologies and to what extent to use them. It therefore sounds reasonable that a teacher, who experienced downsides with a particular technology, may avoid it in the future.

Nevertheless, this turns out to be an unexpected finding, as similar findings in this detail (the amount and variety of expressed emotions) have not been found in the literature review. This can be explained by the fact that emotional reactions were neglected and not read upon when looking into the review of teachers attitudes. It further surprises me that teachers shared (some of) their emotions as open as they did, because I depict emotions as a rather sensitive and personal issue.
The results of this study furthermore show that teachers feel a lack of involvement in the decision processes. Decisions are made by staff other than teachers in regards to the organizational strategy of digitalization. This in turn results again in emotions, such as frustration, as the responsible staff does not listen to their demands and teachers need to deal with the digital technologies that are put in front of them. The findings also show that this can mean that teachers are dissatisfied due to the fact that they have tools at hand which they do not perceive as useful. They can of course look on their own for the respective tools in the internet, but the lack of knowledge and also lack of support for unofficial technologies makes alternatives not an feasible option. It can also be argued that not all wishes are possible to realize by the university. However, the study shows that teachers at least want to have the feeling that they are heard and their issues are taken seriously.

Consequently, it can be said that the overall attitude of teachers is affected by their pedagogical beliefs, whereas their feelings towards digital technologies is majorly affected by their experiences and particularly with the downsides that they encounter in their day to day practice. This brings us to the barriers the teachers face.

5.1.2 Barriers
Unsurprisingly, the study found that one of the major challenges teachers are facing is that the digital technology use in teaching is too time consuming. The findings show that teachers on the one hand do feel a lack the time to use the digital technologies in a comprehensively manner. On the other hand the study shows that they do not have enough time to learn the technologies or to try and learn potentially valuable new technologies. These findings affirm the conclusions of prior research and are in coherence with the results from Tondeur et al. (2017), who see the required time commitment of teachers – which comes along the technology use – as a major downside. It further confirms the findings by Berge and Muilenberg (2000), who rank the extensive time consumption on the top of their list of barriers.

In contrast to the literature, a number of additional barriers are identified in this study. On the one hand the complexity of the technologies and on the other the teachers tendency to forget are not represented in the literature. A possible explanation for the abundance in literature might be that other scholars have summarized these issues to more generic and broader concepts, such as the ‘Difficulty keeping up with technological changes’ by Berge and Muilenburg (2000). Without knowing what stands behind such generic concepts it is hard to derive much meaning from them. These findings therefore may help to understand in more detail where the problems lie and where they need to be approached.

Without question, these three barriers (time consuming, tendency to forget, complexity) are intertwined and dependent from one another. The complexity plays an important role as it is the factor that leads to the other two. Complex and unintuitive systems are a major reason why teachers cannot remember how to perform their tasks in them. It is a time consuming process to learn and remember them in order to conquer the complexity.

The study shows furthermore that the digital technologies are not developed well enough to interact with the students properly through the technologies. This interaction is not only, but especially desired in the context of distance education. It turns out that the lack of interaction is one of the biggest issues for teachers as the insufficient
interaction is in conflict with their pedagogical beliefs. This finding matches Kirkups and Kirkwoods (2005) statement, that interaction between teachers and students is of major importance when teaching with digital technologies. And also the historical perspective of digital technology development showed us how the importance of interaction evolved in the past.

The technological downsides that the study identifies depict a central barrier to digital technology use in education. The study indicates that several teachers experience the same issues on a regular basis. A further barrier that is in direct relation to the technological downsides is the burden of teachers to do work redundantly. It is likely that too much work needs to be done by the teachers due to the technological downsides as the systems may not have the abilities or fail on you. This in turn means that work is done repeatedly and the wheel is often invented over and over again. Furthermore, these downsides also have an impact on other barriers, such as the lacking interaction which has considerably been caused by bad sound and picture quality.

Issues regarding the support and training of teachers are another important finding from the study. The findings show that teachers come in contact with support instances and encounter barriers when utilizing the support services. Also other scholars (Liu et al., 2017; Berge and Muilenburg, 2000) identify a limitation in support and training. Berge and Muilenburg categorize the support barriers into a lack of technical support and into the lack of course development support. The result of the study shows similar results, whereas the biggest lack is seen in the pedagogical support of how to properly utilize the digital technologies in teaching. Also the OECD (2010) refers to the limited knowledge about how digital technologies can be applied in a reasonable way. These thoughts are also consistent with the findings by Porter et al. (2016), who argues that this sort of pedagogical support is important for teachers in order to successfully adopt technology.

Interestingly, this study shows that a part of the barrier is the physical, as well as organizational distance, between educational technologist and teachers. This makes a close collaboration between educational technologist and teacher troublesome. It is not unsurprising that this has not been found in this context in the literature as it depicts a finding that is rather induced through the local organizational structure.

It is relevant to note that no major concerns regarding the technical IT support were identified in this study. However, it is doubtful that they do not exist. I rather believe that the fact that this study adopted explicitly an perspective focused on the teaching made the pedagogical issues stand out for the participants. This may explain that the participants did not reflect extensively on the technical support.

Further, the organizational resistance to change, referred to by Berge and Muilenburg (2000), cannot be found in the findings of this study. The findings rather suggest that there is an overall organizational barrier. The study found institutional constraints that hold the teaching activities as well future developments back. Authority restrictions limit the teachers functional ability to access certain parts in the system. This, in fact, is again in relation to the attitudes and feelings of teachers, because teachers do not understand why they cannot be trusted with some things in the system and their access is restricted. This can consequently also lead to negative emotions.
Further, due to the lack of an governmental body in Sweden, fundamental decisions concerning digital technology strategies are automatically step-by-step delegated down to the teachers. The missing guidance that would be attainable by policy decisions cannot be absorbed by the teachers, and as a result, universities, faculties or even teachers reinvent the wheel over and over again. In a broader perspective this means that Sweden and Lnu consequently miss out on superior guidelines to steer the digitalization process in higher education.

Interestingly, the study did not detect any findings concerning the desire of faculty compensation or incentives, to which Simonson et al. (2014) and Berge and Muilenburg (2000) refer. Contrary to them, this study neither identifies an unmet need of teachers to be rewarded for the digital technology use nor did participants report about incentives being their motivation. A possible explanation for this may be seen in reference to the prior discussed general attitude towards technologies. The teachers believe in the benefits that digital technologies promise and perceive them as enough motivation to intend to use the respective technologies.

**5.1.3 Strategies**

Besides following the traditional way, by contacting the IT support or the educational technologist, teachers have found own ways how to deal with the previously discussed barriers. One of the major strategies is that teachers try to find workarounds to the barriers and find alternative ways to achieve the same or a similar goal. The study shows that a common strategy is even to completely avoid the digital technology that causes the problems in their teaching. Others use the digital technology just to the extend of their own capability.

There can be a variety of reasons why they decide for either one of these strategies rather than asking the support for help. One might be that they do not want to deal with the same issues and asking for support over and over again. Further, the results depicted earlier that teachers are considerably limited in their available time and asking for support may not be the most viable form of dealing with these barriers in that given moment. The lack of trust teachers developed through their experiences furthermore may lead to a general refusal of a technology, which cannot be restored by an ordinary support or training session.

**5.2 Implications of the Findings**

First of all, I believe that it is a good and essential starting point for future improvement that the teachers do have an overall positive attitude towards technologies. This in turn means that actions in order to create a principle trust in technologies do not need to be taken. Without that positive attitude, I believe that an organization first of all would have to recover the trust in digital technologies again.

But as this is not the case, having gained more knowledge about the attitude and the feelings, it enables us to comprehend better what effects such barriers can have on the individual and that there is a whole other humanely level that should be kept in mind when addressing the barriers. Otherwise it would easily happen to only see the isolated barriers, but not the people around it.

The findings show that the systems complexity is an essential issue to address as it has an notable impact on other barriers, such as the time consumption or tendency to forget. The implication of that is that reducing the level of complexity is already likely to
improve the situation with other barriers. It stands out that interaction is a very important asset which needs to be addressed to a satisfying extent in order to allow distance education to happen. Without interaction, distance education appears to be nearly impossible.

The findings show that the support instances need to be better and more consistently integrated into the faculties. Teachers need to be made aware of the role of educational technologists, and efforts need to be made to move from a “how do I use that tool” perspective towards a perspective that embeds digital technologies into pedagogical strategies. Further, the organization should debate again to what extent some of the restricted authorities in the system are reasonable. It should be at least clearly communicated what restrictions are in place and why.

The findings help us to understand that teachers have own ways to circumvent problems. However, it is important to note that sometimes technologies that should be used are due to the barriers neglected by teachers. It is furthermore possible that the performed workarounds may not comply with the policies of the organization and are therefore not desirable.

From a more general perspective, other organizations with a similar technology infrastructure may be able to adapt some of these findings. It is important to point out that the attitudes, the different barriers and respective strategies are all intertwined with each other. As a result, issues can hardly be examined in isolation.

Due to the varying application scenarios in the diverse educational settings all over the world and the qualitative characteristics of this study, the generalization of the findings is limited. However, due to the use of these widely deployed digital technologies in the education at Lnu, the study is not only able to examine arising issues with the digital technologies in the local domain of the Lnu, but may also be applicable to a broader domain in higher education. The findings may be applied in the future in other educational organizations with a similar infrastructure of digital technologies.
6 Conclusion and future research

Digital technologies in higher education hold promising benefits for the university, the teachers and the students. A lot of research effort has been put into examining perceptions of students and their experiences with the use of digital technologies.

But daily practices show that the use of digital technologies is filled with challenges for teachers, and that barriers hinder them to profit from the potential benefits. In order to harvest these benefits, organizations need to address the barriers which are in between them and the benefits. Hence research concerning the perspective of the teachers is limited, this study took a closer look into the digital technologies, the attitude of the teachers, the barriers, and the strategies teachers developed to get around the barriers which they encounter.

As the results show, the barriers are everything but simple and isolated issues, which can not be addressed one by one in order to be able to benefit from the digital technologies as much as possible. Instead, the study shows that there are a plethora of barriers all intertwined with and impacting each other.

This study contributed to gain a better understanding of the types of barriers. It identified some of the most important dependencies between them and therefore enables the organization and possibly similar organizations to take first steps towards a digital technology setting which is able to utilize the benefits to the biggest possible extent.

Future research can be done in a similar setting in higher education. An comparison between Lnu, as an quite young university, and another older Swedish university would be an interesting setting. It would be interesting to see if an older university experiences the same issues concerning digital technologies, or if the timely ‘advantages’ play a role in the sophistication of the digital technology setting.

Due to the fact that this research has a quite huge base of findings, it would be interesting for future research to further examine one particular barrier and its dependencies in more detail. As an example, this could be the problem of limited interaction with digital technologies, and the impacts of its dependencies to the technological downsides.

Last but not least it would be an interesting experiment to compare the barriers, which teachers experience in a traditional classroom setting, with the ones that teachers experience in distance education. As this study did not differentiate between pure on-campus teachers and teachers with experience in distance education, it would be furthermore interesting to see the differences between those two groups of teachers.
References


Appendices
Appendix A – Interview Guide Teachers

Q 1. I’d like to start off with some general information about you. Could you please tell me…
   a. …to which department and faculty you belong to.
   b. What is your role there?
   c. Could you tell me a bit about your teaching experience? How long have you been teaching in higher education? For how long have you been here at Lnu?
   d. What kind of responsibilities/tasks do you have that are related to teaching?

Q 2. Which digital technologies do you use to fulfill these responsibilities? Can you name them?
   a. What do you use them for?
   b. Which ones do you use the most?

Q 3. How do you feel in general when using these technologies and why?

Q 4. Do you encounter any problems when using these digital technologies? What are they?
   a. With which digital technology do you encounter the most problems?
   b. Are you usually able to solve these problems on your own? How?
      i. If not, what do you usually do?
      ii. Are there services provided by the university where you can ask for help?
         • Did you ever use this service?
         • Did you perceive the service as helpful?
      iii. Did you receive any kind of training or introduction to new technologies when they are adopted?
         • If yes, what do you think about it?
   c. Are there any functionalities in these technologies that you have never used because you don’t know how to use them or because they are too complicated to use? Or you did not feel the need?

Q 5. Are the different technologies compatible with/integrated in each other?
   a. Where (else) do you think a compatibility/integration would be reasonable?

Q 6. Do you think the digital technologies you are using are useful for your teaching activities? Why? Why not?
   a. Has the handling with technology ever hindered you from focussing on the actual teaching?
      i. In what occasions and how does it hinder you?
   b. When you look back to the time where no or only very few technologies were used in teaching, do you think that technology has increased or harmed the quality of teaching? In what ways and why has it influenced the quality?
c. Are there digital technologies you are solely using because you have to use them and not because you think they are beneficial?
   i. Why do you perceive them as not beneficial?

Q 7. If you could improve or add one functionality of a digital technology of your choice, what would it be?

Q 8. Would you describe yourself in general as an experienced user of technologies? (e.g. from the experiences you’ve gained in your free time?)

Q 9. Is there anything else you would like to share?
Appendix B – Interview Guide Educational Technologist & E-Learning Specialist

Q 1. I’d like to start off with some general information about you. Could you please tell me…
   a. …to which department and faculty you belong to.
   b. What is your position there?
   c. For how long have you been in this position? And for how long here at Lnu?
   d. What kind of responsibilities/tasks does your position entail?

Q 2. With which digital technologies do teachers come to you to get help in order to fulfill their daily teaching activities?
   a. What are common problems or questions you get asked about these digital technologies?
   b. Do the problems or questions differ very much depending on the experience of the teacher with digital technologies? In what ways?
   c. Which one of these technologies do you think is the most troublesome for teachers? Why?

Q 3. What is your perception of how teachers approach problems they encounter? Do they try to figure it out by themselves or with colleagues first or do they come to you directly?
   a. Can you give some examples how you can help them?
   b. If you are not able to help them, what do you usually do?

Q 4. Are the different technologies compatible with/integrated in each other?
   a. Where (else) do you think a compatibility/integration would be reasonable?

Q 5. From your experience handling these problems on a regular basis, which functionality of a digital technology of your choice would you improve or add? Why?

Q 6. Is there anything else you would like to share?
Appendix C – Consent form for the Pilot Interview

CONSENT FORM Pilot Interview

Type of Project: Master Thesis
Title of the Project: Investigation of Teachers’ Perceptions on Cumbersome Digital Technologies in Higher Education
Principle Investigator: Julian Stüber
Supervisor: Erdelina Kurti
Examiner: Prof. Anita Mirijamdotter
Organization: Linnaeus University

You will be given a copy of the full Informed Consent Form

Introduction

My name is Julian Stüber and I am a master student in Information Systems at Linnaeus University, Växjö, Sweden. I invite you to participate in this research that investigates the problems and obstacles that teachers encounter when using digital technologies in their everyday teaching practices.

You may take your time to decide upon your participation in the research. Before you decide, you can talk to anyone you feel comfortable about your potential participation in the research. This form may contain words and terms that may not sound familiar, thus, please ask me to stop anytime while we go through the information and I will explain. In case other questions emerge later, feel free to contact me via email: js223uk@student.lnu.se or via phone: 0046 728 461 766

Purpose of the research

The purpose of this study is to explore the nature of problems and obstacles that teachers are confronted with regarding the digital technologies they are using in their everyday teaching practices in higher education. As a result of the ongoing digitalization of our world, universities and their teaching staff are facing the challenge of adopting these technologies in their everyday teaching practices. This digitalization and the potential of distance education paired with the prevailing globalization are increasing the need for universities to retain their competitive ability. Therefore, to enable universities to utilize digital technologies in an efficient and effective manner, the perceptions of the end-users need to be incorporated in thoughts about IT-strategies, visions and pedagogies.

Description of Participant Involvement

You are being invited to participate in this research because I believe that your experience using digital technologies for teaching can contribute and provide valuable insights to my understanding the perceptions of teachers facing the inevitable use of digital technologies in their everyday teaching practices. This research will involve your participation in one interview that will take up to 1 hour. I will take notes during the interview. Upon your consent, the interview will be audio-recorded using laptop/mobile
phone. The transcription of interviews would help me to accurately capture your insights in your own words and as effectively as possible. They will be transcribed in a document and saved by me. You will be asked a series of questions about your experiences with using the digital technologies at Linnaeus University. You can decline to answer any question that makes you feel uncomfortable in any way. At any time you may notify the researcher that you would like to stop the interview and your participation in the study.

**Voluntary Participation**

Through this consent form we make clear that your participation in this research is entirely voluntary. It is entirely up to you to participate or not. However, you may choose to withdraw from the research at any time, even if you agreed earlier.

**Benefits**

Your participation will contribute to the deeper understanding of teachers’ perceptions of digital technologies that are used in the everyday teacher practice. It will contribute to identify problems and challenges that teachers are facing when using the digital technologies and further give insights how those are handled. Eventually it can indicate where authorities need to adjust the intended use of digital technologies. Your involvement will help me to test the interview questions upon attaining the intended insights to ensure the feasibility of subsequent interviews of this study.

**Risk and Discomfort**

There are not any foreseen risk or discomfort from your participation in the research beyond those experienced in everyday life.

**Confidentiality**

Your participation in this research is confidential. All information you provide will be held in confidence and unless you specifically indicate otherwise, your name will not appear in any report or publication of the research. Direct quotes from you may be used in the research; however, upon your request your name and other identifying information will be kept anonymous.

**Access to material**

The collected data such as interview recordings and transcripts, organizational documents, will be used for the purpose of this research only. Moreover, the availability of the recorded material and original transcripts will be limited to the researcher/s who is conducting interviews, supervisors of the thesis, to the examiner of the dissertation.
CONSENT FORM Pilot Interview

Please initial all boxes

1. I confirm that I have read and understand the above information and hereafter agree with statements above. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I agree with audio recording of this interview

3. I want to keep my name anonymous

4. By signing this document, I voluntarily agree to participate in this study. Data and information shared with the researcher can be used for the study/master thesis

_________________________________________  ______________________________________  ______________________________________
Name of Participant                Date                             Signature

_________________________________________  ______________________________________  ______________________________________
Name of Researcher            Date                             Signature
Appendix D – Consent form for the Interviews

<table>
<thead>
<tr>
<th><strong>CONSENT FORM Interview</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Project:</strong></td>
</tr>
<tr>
<td><strong>Title of the Project:</strong></td>
</tr>
<tr>
<td><strong>Principal Investigator:</strong></td>
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<tr>
<td><strong>Supervisor:</strong></td>
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<tr>
<td><strong>Examiner:</strong></td>
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<tr>
<td><strong>Organization:</strong></td>
</tr>
</tbody>
</table>

**You will be given a copy of the full Informed Consent Form**

**Introduction**

My name is Julian Stüber and I am a master student in Information Systems at Linnaeus University, Växjö, Sweden. I invite you to participate in this research that investigates the problems and obstacles that teachers encounter when using digital technologies in their everyday teaching practices.

You may take your time to decide upon your participation in the research. Before you decide, you can talk to anyone you feel comfortable about your potential participation in the research. This form may contain words and terms that may not sound familiar, thus, please ask me to stop anytime while we go through the information and I will explain. In case other questions emerge later, feel free to contact me via email: js223uk@student.lnu.se or via phone: 0046 728 461 766

**Purpose of the research**

The purpose of this study is to explore the nature of problems and obstacles that teachers are confronted with regarding the digital technologies they are using in their everyday teaching practices in higher education. As a result of the ongoing digitalization of our world, universities and their teaching staff are facing the challenge of adopting these technologies in their everyday teaching practices. This digitalization and the potential of distance education paired with the prevailing globalization are increasing the need for universities to retain their competitive ability. Therefore, to enable universities to utilize digital technologies in an efficient and effective manner, the perceptions of the end-users need to be incorporated in thoughts about IT-strategies, visions and pedagogies.

**Description of Participant Involvement**

You are being invited to participate in this research because I believe that your experience using digital technologies for teaching can contribute and provide valuable insights to my understanding the perceptions of teachers facing the inevitable use of digital technologies in their everyday teaching practices. This research will involve your participation in one interview that will take up to 1 hour. I will take notes during the interview. Upon your consent, the interview will be audio-recorded using laptop/mobile
phone. The transcription of interviews would help me to accurately capture your insights in your own words and as effectively as possible. They will be transcribed in a document and saved by me. You will be asked a series of questions about your experiences with using the digital technologies at Linnaeus University. You can decline to answer any question that makes you feel uncomfortable in any way. At any time you may notify the researcher that you would like to stop the interview and your participation in the study.

**Voluntary Participation**

Through this consent form we make clear that your participation in this research is entirely voluntary. It is entirely up to you to participate or not. However, you may choose to withdraw from the research at any time, even if you agreed earlier.

**Benefits**

Your participation will contribute to the deeper understanding of teachers’ perceptions of digital technologies that are used in the everyday teacher practice. It will contribute to identify problems and challenges that teachers are facing when using the digital technologies and further give insights how those are handled. Eventually it can indicate where authorities need to adjust the intended use of digital technologies.

**Risk and Discomfort**

There are not any foreseen risk or discomfort from your participation in the research beyond those experienced in everyday life.

**Confidentiality**

Your participation in this research is confidential. All information you provide will be held in confidence and unless you specifically indicate otherwise, your name will not appear in any report or publication of the research. Direct quotes from you may be used in the research; however, upon your request your name and other identifying information will be kept anonymous.

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CONSENT FORM Interview

Please initial all boxes

5. I confirm that I have read and understand the above information and hereafter agree with statements above. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

6. I agree with audio recording of this interview

7. I want to keep my name anonymous

8. By signing this document, I voluntarily agree to participate in this study. Data and information shared with the researcher can be used for the study/master thesis

________________________________  __________________________  __________________________
Name of Participant                  Date                          Signature

________________________________  __________________________  __________________________
Name of Researcher                   Date                          Signature

XVI