PROFESSIONAL DIGITAL COMPETENCY OF PRE-SERVICE TEACHERS

A case study of Teacher Training Program at the University of Oslo, affiliated with the Centre of Excellence, ProTed.

Wardah Ahmad

Master of Philosophy in Higher Education 30 credits

UNIVERSITY OF OSLO

Faculty of Educational Sciences

Autumn 2021

Professional Digital Competency of Pre-service Teachers

A case study of Teacher Training Program at the University of Oslo, affiliated with the Centre of Excellence, ProTed

Thesis submitted in partial fulfilment of the requirement for the Degree of Master of Philosophy in Higher Education.

2021

Professional Digital Competency of Pre-service Teachers

A case study of Teacher Training Program at the University of Oslo, affiliated with the Centre of Excellence, ProTed

Wardah Ahmad

http://www.duo.uio.no

Trykk: Reprosentralen, Universitetet i Oslo

Abstract

The Professional Digital Competency of the teachers is becoming a growing concern with the growing dependence of digital tools, digital resources and digital media for teaching and learning in the classrooms. With the increasing demands of integrating the digital tools in the learning environments, the national initiative of Centres of Excellence in education aims to promote the inclusion of innovative digital development nationwide through their long-term innovative research-based development.

This thesis explores the impact of Centres of Excellence, ProTed: Centre for Professional Learning in Teacher Education, on the development of Professional Digital Competency of the Pre-service Teachers. The study specifically explores the development of Professional Digital Competency among the Pre-service Teachers by investigating their experiences of the innovative study designs formulated by ProTed and implemented at University of Oslo.

The study incorporated qualitative semi-structured interviews on the student teachers in their last years of Teacher Training Programs to document their experiences and analyze their Professional Digital Competency before they enter the job market. The Professional Digital Competency of the Pre-service Teachers was evaluated using Krumsvik's Teacher's Digital Competency Model (2012).

The data was analyzed by the 'meaning condensation method' and revealed diversity in the experiences of the Pre-service Teachers. The student teachers were more self-aware than practically proficient and craved for study design that have both the practical and the theoretical approaches related to the integration of digital tools in the classrooms. The study also portrays that there is some level of inconsistency between the aims projected by ProTed and the experiences of the Pre-service Teachers. Moreover, the Pre-service Teachers are hugely driven by their own motivation and have a positive attitude for integrating various digital tools in the classrooms.

Acknowledgments

This Master's thesis could not have been written without the love and support I received from a number of people surrounding me. I would like to extend my gratitude to these people that provided me with assistance and encouragement in the times I needed most.

I would like to extend my gratitude to my supervisor, Professor Thomas de Lange for his careful guidance, endless patience and support, and for sharing your expertise with me. I am very grateful for his constructive feedback and in-depth advice which has deeply helped me in shaping my thesis.

My heartfelt thanks to my colleagues, especially Lynn, Wulan, Grace, Damla and Anshu for encouraging me in finally completing my thesis. I am in debt with the kindness they have showered upon me during the course of my Master's. I have also been blessed with wonderful friends and I would like to thank them for bearing with me. I would like to mention Mr. Syed Touqeer and his lovely wife Saima Baji for reading my thesis and loving me so much.

I would also like to thank my husband, Ejaz Ul Haq for encouraging me to write and motivating me to complete this thesis. My family and my son Muhammad Ibrahim for the love and care.

Finally, I would like to thank NOKUT for supporting this study and honoring me
to receive the scholarship for writing this thesis

Table of Content

Overview of Tables and Figures

List of Abbreviation

CoE-E: Centres of Excellence in Higher Education

CoE-I: Centres of Research-based Innovation (CoE-I)

CoE-R: Centres of Excellence in Research

CoE: Centre of Excellence

GDPR: General Data Protection Regulations

ICT: Information and Communication Technology

LMS: Learning Management Systems

MOOCs: Massive Open Online Courses

NOKUT: The Norwegian Agency for Quality Assurance in Education
(Nasjonalt organ for kvalitet i utdanningen)

NSD: Norwegian Centre for Research Data (Norsk senter for forskningsdata)

PDC: Professional Digital Competence

PDCM: Professional Digital Competency Module

ProTed: Centre for Professional Learning in Teacher Education

PST: Pre-service Teachers

SPOC: Small Private Online Course

TCK: Technology Content Knowledge

TPACK: Technological pedagogical Content Knowledge

TTP: Teacher Training Program

UiO: University of Oslo

UiT: The Arctic University of Norway (Norges Arktiske Universitet)

VVPL: Video based Mentoring in Practice Placement in Teacher Education (Videobasert eiledning av praksis I lærerutdanningen

WP: Working Packages

CHAPTER 1: INTRODUCTION OF THE STUDY

1.1 Introduction

The world has been experiencing a digital revolution that has transformed all sectors of society and has increased the demand for digital skills in the labor market. Currently, digital technology is seen as a driver for economic development, social change, and cultural transformation both national and international levels. This progress in digital technology has extended traditional modes of communication, sharing information, defense, business and commerce, security, and education. Thus, this form of technology has become a survival tool and is also true for Norway as stated,

> ICT [Information and Communication Technology] provides the core enabling technologies for harnessing all other sciences and technologies, in that it ameliorates barriers of distance, scale, and complexity that so quickly otherwise deter our ability to understand and control systems on which our lives and societies increasingly depend (The Research Council of Norway, 2012, p. 5).

As dependence on digital technology has grown the education sector, like all other sectors, has equipped a new generation with the necessary digital competency to join the future workforce. Similarly, Digital Strategy for Norwegian Development Policy paper highlights the establishment of an education system that *"prepares people for modern working life and for universal participation in the global economy"* (Ministry of Foreign Affairs, 2018, p. 5). This policy vividly portrays the importance of digital knowledge and solutions in improving the quality and access to education.

With an investment of about NOK 800 million, the Norwegian higher education sector is at the forefront of providing digital skills to boost technological integration to equip the new generation with essential digital competence (Ministry of Education and Research, 2018). However, with such a strong focus and monetary incentive at the national level, the white paper [1]reports the shortfalls

[1] In Norway, the white papers are reports that the Government writes to inform Storting (Parliament) on past works or future policies. These reports do not require decision and sometimes becomes foundations for future policies and bills.

and the inadequacies of teachers in integrating digital tools [2]in classrooms and mentioned that *"newly trained teachers have not been given sufficient academic digital skills as part of their basic training"* (Ministry of Education and Research, 2018). Thus, this thesis aims to further explore the experiences of Pre-service Teachers (PSTs) during their formal study years and to analyze the digital skills of these newly trained teachers.

1.2 Digital technology in Education:

The extensive new wave of digitalization has paved a path for adopting and integrating digital technologies into the education sector. Furthermore, the new millennium has brought a high demand for the integration of digital tools in schools and universities to prepare students to respond to the demands of future workplaces. That is, increasing emphasis has been placed on digital competency, the integration of multimedia resources, and the digital medium of operation in industries and services. National authorities have provided the physical infrastructure of digital tools and have made digital skills compulsory in school curricula. However, there has been a limited narrative on the development of professional digital competence (PDC) of teachers in the national regulations and the curricula of Teacher Training Program (TTP) especially in Norway (Instefjord & Munthe, 2016; Larkin et al., 2012). Therefore, this study aims to explore the educational study designs of PSTs to discover how their experiences led to the development of their digital skills.

Typically, digital technologies are recognized as tools for achieving desired educational outcomes, effective pedagogy, innovative teaching and learning practices, and student engagement in becoming self-regulated learners (Redecker & Punie, 2017). Moreover, technological integration has begun to support traditional teaching practices with interactive boards to deliver content with a more didactic use in classrooms (Beetham & Sharpe, 2007, pp. 2–9). In the current learning environment, to use technology as a pedagogical tool, teachers must be competent enough to recognize, integrate, and use digital tools linked to pedagogy and their subjects.

[2] In this thesis, the word digital tool is used to refer to ICT tools, applications, software, hardware that are now becoming part of education sector.

1.3 Centers of Excellence:

The creation of Centres of Excellence in Teacher Education (CoE-E) has been a notable initiative that aims to enhance and stimulate the quality of teaching, research, and innovative approaches in education embedded in universities. In general, CoEs work as national institutions to build highly competitive systems, emphasizing a program's quality, scientific productivity, international networking, societal impact, and contributions to national goals, such as boosting ICT integration. Beyond this, CoEs focus on promoting R&D-based education, and they are designed to facilitate student interactions regarding realms such as academics, industry or labor markets, and professionalism. Such work improves these programs' educational outcomes.

Furthermore, the CoE are reported to have the following characteristics

> [They have] long-term funding and considerable industry investments, leading to a focus on mission-oriented research … and a high level of autonomy … of the centre's research, on the one hand. On the other hand, since academic organizations often host these centres, they also need to position themselves towards university implemented reforms and audits. (Larsen, 2019, p. 2)

Additionally, CoEs are responsible for teaching, researching, and planning content for relevant programs. These organizations also contribute to the diversity of universities' strategies, forming networks with the industries while maintaining a certain autonomy in arranging and pursuing their own core ambitions by collaborating with industries, universities, and governments. Furthermore, "*many excellence initiatives originate from a national innovation strategy, in which the public research sector represents a crucial building block*" (Wespel et al., 2013, p. 13). These centers have conducted extensive research focusing on social challenges and innovation. In this study, the aims, ambitions, and impact of the study designs from the renowned Norwegian Centre of Excellence, ProTed situated at the University of Oslo (UiO) are explored later in this thesis.

1.4 Aim of the Study

The motivation for this thesis is derived from the ongoing increase in the use of technological tools in the classrooms and the increasing dependency on these tools for effective pedagogy. The aim of this research is to explain the digital competency of teachers who enter the school sector.

Additionally, this study investigates the experiences of PSTs as they develop their digital competency in the formal TTP in Norway. In this context, the TTP shares a close collaboration with a CoE called ProTed: Centre for Professional Learning in Teacher Education, with the aim of improving the quality of teacher education.

Generally, the TTPs incorporate various research-based approaches to enhance their teachers' digital competency and promote didactic ways of integrating innovative digital tools and teaching practices (Røkenes & Krumsvik, 2014). Therefore, this study investigates, based on a qualitative design, how objectives set by ProTed on digital proficiency and competency of integrating digital tools in classrooms is experienced by a small sample of PST's enrolled at this TTP.

1.5 Problem Statement:

The integration of digital technology for the attainment of educational outcomes, curricula development, teaching method applications, and other purposes has been a great challenge for teachers. In the Norwegian context, there have been challenges with the "*slow uptake of ICT*" (Tømte, 2015), coupled with a lack of recognition of the affordances of digital tools in TTP to develop digital competency among teachers and students. Studies have revealed that PSTs' main concerns are the deficiency of ICT training with various digital tools, the lack of support from the management and institutions, and insufficient awareness of the pedagogical and content-specific uses of digital technology (Gudmundsdottir & Hatlevik, 2018; Tømte, 2015). Additionally, many studies on the uptake of digital technologies have highlighted the struggle between the policies and the actual enactment of the integration of digital tools in classrooms (Olofsson et al., 2011). These policies aim to provide the necessary incentives, support, and funds for pursuing digitalization in the education sector. However, such national efforts have been criticized for lacking the proper investment structure, strategies, and research for the successful integration of digital tools (The Research Council of Norway, 2012).

In the Norwegian context, national policies have sometimes been founded through the research conducted by these CoEs, the units where research and teaching connect at a higher standard than other formal educational organizations (Wespel et al., 2013). Another way of strengthening research, teaching, and skill capacity is through the excellence initiatives implemented by national governments. These CoEs aims to convert national policies into their core activities and strategies

to enhance program quality through teaching and research. Furthermore, the following is true regarding the research expertise behind CoEs:

> Excellence schemes can be seen as a means to pinpoint scientific value creation through tried and tested operational patterns, and teaching initiatives have a more explorative character: they are expected to help clarify what excellent teaching is all about in the first place. (Wespel et al., 2013, p. 15)

Thus, CoEs are praised for their innovative research that gets published in scientific journals. On the other hand, they are often criticized for being less inclined toward teaching responsibilities (Hellström, 2018). Given the above discussion, this thesis aims to provide a distinct approach to previous studies on PSTs and their digital competency with an emphasis on teaching responsibilities. With the strong affiliation between CoEs and ProTed, this study aims to explore the experiences of PSTs to investigate how the models for innovative educational practices enable future teachers to enhance their digital competency during their TTP.

1.6 Research Question:

To explain the digital competency of PSTs and understand the role of their formal TTP coordination with the CoE: ProTed, this thesis investigates the following questions.

Q1: What are the experiences of pre-service teachers during their formal teacher training program that are part of ProTed's goals for enhancing professional digital competency?

To answer this question, the researcher explores the perceptions of teachers of the incorporation of digital technology in the classroom and their competency as teachers. The question will further illustrate these teachers' experiences with the implemented learning designs by ProTed as part of their formal TTP at UiO.

Q2: To what extend do the pre-service teachers of the current study experience that the formal teacher training program contributes to their development of professional digital teacher Competency?

In addressing this question, the researcher uses the Teacher´s Digital Competence Model composed by Krumsvik (2012) developed in the Norwegian context to evaluate the digital competency of educators. The framework will help me to scrutinize the experiences of the PSTs of their learning designs and how their perceptions of own digital competencies related to the competence model.

1.7 Significance of Study

Limited studies have been conducted on the impact of CoEs on students' (prospective teachers') experiences in the field of teacher education, and most of these studies have occurred in the fields of medicine and applied sciences. Additionally, this study aims to provide an in-depth analysis of students' development of digital competency in a formal, five-year teacher education program that collaborates with the CoE called ProTed.

In Norway, the CoEs are evaluated at midterm or after five years to determine whether they should be extended for another five years. The CoEs' research performance, productivity, annual goal attainment, international collaboration, quality, and other facets are formally evaluated by NOKUT[3] (the Norwegian Agency for Quality Assurance in Education). However, in this study, the focus is limited to exploring how the CoE's ambitions on developing digital competencies of their students parallel with the teacher students' own experiences and notions on digital competencies.

Furthermore, this thesis thoroughly investigates the influence of CoE on PSTs' experiences in developing their digital and proficiencies to integrate digital tools in their classrooms. By identifying PSTs' capabilities, limitations, strengths, and weaknesses, this study could be helpful for educators, their teachers, and policymakers to further help PSTs attain their future goals, forming a basis for the potential upgradation and adjusting of the TTPs.

[3] NOKUT (Nasjonalt organ for kvalitet i utdanningen) is an expert autonomous body that provides expertise at the higher and tertiary education in Norway. Their main aim is to provide evaluation and accreditation services.

1.8 Thesis Structure

The thesis comprises seven chapters further split into subdivisions. Chapter 1 provides the main introduction of the thesis and the aim, problem statement, research questions, and significance of the study. Chapter 2 summarizes the literature review relating to the digital competency of PSTs. This chapter provides an overview of the various dimensions of digital integration and the challenges and strategies that support or distract teachers in integrating digital tools in their classrooms. Additionally, this chapter encapsulates the scientific literature published by the academics from the CoE ProTed. Next, Chapter 3 gives the background, referring to national frameworks and political efforts to enhance digital competency among teachers and supplying an in-depth context for the CoE ProTed, which is the context of the study.

Chapter 4 provides a thorough description of the analytical framework for this study. The framework used in this thesis is the Teacher's Digital Competence Model proposed by Krumsvik (2012). Additionally, this chapter provides an in-depth explanation of the analytical framework to analyze the data. After this, Chapter 5 concerns with the methodology of the Case Study, which involves the research design, methodology, sampling, tools for data collection, and data analysis. This chapter also states the quality criteria and ethical considerations for this study. Subsequently, Chapter 6 explores the findings and analysis of the data based on student interviews. Lastly, Chapter 7 discusses the main findings and provides recommendation and limitations of the study.

CHAPTER 2: LITERATURE REVIEW

This literature review provides an overview of previous studies concerning the perceptions and experiences of the pre-service and in-service teachers on the development of their PDC. Moreover, this section also discusses the challenges and shortfalls teachers have been facing that facilitate or prevent the use of digital tools in their classrooms. The literature review is composed of numerous research studies at the international and national levels to explore the significant perspectives connected to the realms of teacher education and digital competencies.

This chapter commences by defining the term "digital competence" in the Norwegian context, incorporating the operational definition of "professional digital competency" that is used extensively throughout the thesis. Additionally, this area briefly explores the scientific literature on the integration of various digital tools for teaching and learning. Lastly, this chapter explores the different aspects of developing PSTs' digital competency for their future profession during the formal years of their TTP.

2.1 Defining Digital Competence

The introduction of digital technologies in the classrooms has changed the basic skills of reading, writing, and verbal expression and has instigated a demand for teachers to have a competency for applying digital learning strategies to enhance students' education (The Norwegian Directorate for Education and Training, 2012). With society's increased interest in the concept of digital competency in the education sector, this term has appeared in many policy papers at the macro level as an object of change and development for any citizen (Krumsvik, 2012). In the Norwegian context, the inclusion of digital competency is referred as the fifth basic skill in the educational curricula, educational reform, and the General Plan for Teacher Education which highlights the importance of digital competency in Norwegian educational policies (Krumsvik, 2012). According to the framework of basic skills, the following is true:

> Digital skills involve being able to use digital tools, media, and resources efficiently and responsibly, to solve practical tasks, find and process information, design digital products and communicate content. Digital skills also include developing digital judgment by

> acquiring knowledge and promising strategies for using the internet. (Mentioned in Krumsvik, 2011, p. 43)

Another aspect highlighted in this context is the development of judgment on the user's part while operating digital resources like the internet. After scrutinizing the discourse of policy documents, steering documents, and reforms, Krumsvik provided a practical definition for the term digital competency regarding teachers in the Norwegian context. Krumsvik suggested that *"digital competency is the individual TE's proficiency in using ICT in school with good pedagogical judgment and awareness of its implication for learning strategies and digital Bildung of pupils"* (Krumsvik, 2012, p. 466). This idea demonstrates the importance of teachers' awareness and their practical proficiency in making decisions about integrating digital tools in classrooms according to their subjects and intended learning outcomes. Furthermore, Krumsvik's definition of digital competency of the individual teacher and the Teacher's Digital Competence Model is applied later in this study to illustrate the development of PSTs (Krumsvik, 2012).

2.2 Digital Tools in Teaching and Learning

To explain the role of technology in the realm of teaching and learning, this section first explores the purpose of technology integration. The educators and pedagogical experts mention that the primary purpose of integrating technology is more than the inclusion of technology in classrooms. It is understood that

> … integrating technology is not about technology – it is primarily about content and effective instructional practices. The technology involves the tools with which we deliver content and implement practices in better ways. Its focus must be on curriculum and learning… Integration is defined not by the amount or type of technology used, but by how and why it is used. (Earle, 2002, p. 7)

The inclusion of technology in the education sector has produced an extensive research area, inculcating the theory of constructivism. According to constructivism, meaning is constructed from beliefs, experiences, and social contexts where personal experiences and interactions play critical roles (Fosnot, 2013; Phillips, 1995). Additionally, digital learning environments make

learners more active and allowing them to construct their own meaning of the knowledge within these environments.

Regarding the integration of digital tools in teaching and learning, studies suggests that digital tools make learning more flexible in the classroom. For instance, such tools as LMS enhance student's digital learning environments by providing access to educational resources and is a platform for communication and collaboration with colleagues (Shimada et al., 2019). Thus, it also suggests that technology integration has contributed to reduce the constraints of time and space (Garrison & Kanuka, 2004). The Massive Open Online Courses (MOOCs) are for example a type or resource for learners to study at their own paces and in their preferred areas. Beyond this, MOOCs and open online spaces also provide program designs allowing self-directed study where the students can progress in their own pace based on using digital tools for learning and teaching (Nerantzi & Beckingham, 2015). However, in this study, digital tools are used in classrooms, along with other non-digital educational tools. Thus, the literature also points towards the concept "blended learning," where the blending of online learning and classroom instruction tends to support teaching practices and student-centered learning and to support students' engagement in the classrooms (Torrisi-Steele & Drew, 2013).

Furthermore, in digitally supported and student-centered learning environments, teachers aim to promote students' knowledge construction, comprehension abilities, and critical thinking skills by incorporating specific digital tools. Additionally, these teachers' digital skills are not only used to help teachers to increase students' knowledge of digital technology, but also allow them to implement digital resources for class management, assessment, feedback, and subject didactics (Lund, Furberg, et al., 2014). If applied accordingly, practical use of digital tools tends to impact productively on students' digital skills and their adoption of digital tools. On this subject, Mirriahi and Alonzo conducted an empirical study on students' technological preferences. They concluded that for decades, apart from the use of mobiles devices, students had tended to choose limited educational technologies and became uncomfortable in courses incorporating a diversity of digital tools, suggesting academics' limited use of such tools for teaching and communicating (2015). Beyond this, this study indicates that students use of educational technologies at home vary considerably and demands an increase in digital technologies in education settings. This also relates to the integration of digital tools for assessment and feedback, collaboration with peers and academics, administration, and podcasts for flexible learning experiences.

The teachers are required to understand the real affordances of the digital tools, proficient to integrate and able to assist students with digital tools in the classrooms. In digital learning environments, the inclusion of digital tools, such as tablets, requires teacher to practice and aware of its' effects on student learning outcomes (Krumsvik et al., 2019). Even in smart classrooms [4]and digital learning environments, where students are more independent and actively engaged with their own learning, a teacher's presence can positively impact students' motivation and learning (Bdiwi et al., 2019). The inclusion of digital tools and new pedagogical practices does not undermine the role of teachers in the classrooms.

Next, digital competency is strongly associated with access to digital technology, strong school leadership, teachers' PDC, and overall school development (Erstad, 2010). This study revealed that students enrolled at TTP were digitally fluent in their informal and personal technology uses, such as social media and Web 2.0[5]. However, the TTP are not necessary well aligned with the abilities and expectations of these digital natives (Duncan-Howell, 2012). Thus, teacher training programs can extend teachers' digital competency and enhance their experiences through understanding students' basic digital competency to focus more on didactics, learning strategies to cultivate digital Bildung [6](Krumsvik, 2012, 2014).

2.3 Pre-service Teachers' Digital Competency:

Teachers play a significant role in students' uptake of digital tools in the classroom (Jimoyiannis & Komis, 2006; Olofsson et al., 2011). For instance, a teacher takes the actual decisions regarding when and how technology should be integrated into their classrooms (Jimoyiannis & Komis, 2006). In other words, teachers are the key agents determining when technology should be integrated. There is therefore little doubt that teacher training institutions should play an important role in forming experiences and skills of student teachers in shaping their future classroom practices (Agyei & Voogt, 2011; Drent & Meelissen, 2008). TTP do provide such

[4] Smart classrooms have extensive integrated technology for teaching and learning. These devices include computers, interactive smart boards, audience response devices and assistive listening devices, internet and other integrated networks etc.

[5] Web 2.0 (post-dotcom World Wide Web) denotes the variety of websites and applications for social networking that allows the user to get and share information for example Facebook. Twitter, web blog pages etc.

[6] According to Krumsvik (2012) Digital Bildung refers to the development of digital identity among the teachers where the teachers is not only competency in integrating digital tools but also understands the ethical and moral issues.

opportunities for developing skills and knowledge for incorporating technology in the classroom, but this varies in degree and emphasis. Moreover, teachers' beliefs and motivations are also crucial in integrating technology into their classrooms (Giles & Kent, 2016; Paraskeva et al., 2008).

Additionally, the TTPs are aiming to provide student teachers relevant knowledge about digital tools required for their profession. However, TTP have been criticized for not teaching the PSTs with and about the technology they need to teach specific curricula during their service (Groth et al., 2007). This criticism has occurred due to many PSTs' inefficiency in adopting relevant digital resources for teaching. Furthermore, studies also point to the struggle PSTs encounter in integrating technology and understanding the essence of the affordances that digital tools can bring to classrooms (Lei, 2009; Pamuk, 2012; Valtonen et al., 2011). Even so, ten-year international research on PSTs' digital competency regarding digital technology integration concluded that there is still insufficient evidence of the impact of institutional infrastructure and leadership on teachers' development of digital competence (Pettersson, 2018). This reflects a lack of conclusive research on the impact TTP have on the development of digital competency required by the future teachers.

The question relies on what kind of knowledge is needed for teachers to successfully integrate technology into the classrooms. Research has shown that the PSTs require knowledge of a curriculum, technologies relevant to that curriculum, and pedagogical theories related to the integration of technology into (Gueudet & Pepin, 2019; Kastberg, 2005; Ruiz, 2019). There are a lot of positive examples of programs that emphasis on the development of digital competency among the PSTs of subjects like mathematics and general science. Many of the programs within these disciplines have explored areas such as understanding curricula and how to integrate technological concepts into those curricula, understanding students' existing knowledge, knowing how to use digital tools for teaching and learning, and knowing how to use instructional strategies for teaching and presenting concepts (M. L. Niess, 2005). Technology instruction in scientific disciplines is different from that of other subjects; that is, PSTs' instruction abilities involving technology can be facilitated if similar practices occur in their teacher training program (Bell et al., 2013).

This leads to the importance of experience among the teachers to learn and practice their ability to use technology during their education to understand how the theoretical world meets the practical world in their profession. Prior research has suggested that PSTs' learning potential can

be enhanced by using cognitive modeling of ICT to portray how teachers make decisions for selecting and integrating digital tools in their classrooms (Pamuk, 2012; Røkenes & Krumsvik, 2016). Another vital element for PSTs to enhance their digital competency is through fieldwork, which is mandatory in the Norwegian context. This integration of technology in such fieldwork reinforces PSTs' practices for selecting and incorporating digital tools in their teaching (Giles & Kent, 2016; Groth et al., 2007).

Several studies also suggest that PSTs struggle to incorporate their knowledge of technology into their class content and pedagogy due to a lack of practical enactment. For instance, Niess wrote the following:

> No matter how marvelous the coursework is in providing them with knowledge about teaching with technology, they must have opportunities to apply this knowledge. For them to learn teach with technology, PSTs must be more than spectators in the classrooms. (2008, p. 246)

A teacher's fieldwork portrays their abilities to teach and provides them with an opportunity to reflect on their practices. In this vein, practicum feedback is a process that involves a mentor, university professor, and students in many countries, that allows the PSTs to learn more about the practical integration of digital tools. Practicums are important in raising awareness regarding teaching and learning, and they also help to merge pedagogical knowledge with subject didactics in the enactment of these practicums. For example, research has provided evidence on how these three characters (pre-service teacher, mentor, and university academic) interact, providing their awareness and convictions are embedded in their specific context and expertise. Additional research has confirmed that metacognition, which reflects student experiences, is another dominant technique for raising awareness of PSTs' didactic use of digital tools (Røkenes & Krumsvik, 2014, 2016). Furthermore, metacognition as a strategy can be incorporated into teacher training programs to support PSTs in understanding their respective disciplines and strategies they can adopt for the successful integration of technology into their classrooms.

As the context of this study is Norway, one must understand the current state of the country and what elements that play key roles in enhancing the digital competencies of PSTs there. In the Norwegian context, there is a discrepancy in education systems between general education

system and teacher education. On the one hand, there is an acute emphasis on the basic skills and digital integration in classrooms. On the other hand, there have been limited references in the curricula to the TTP (Instefjord & Munthe, 2016). Furthermore, with the changing paradigms of teaching and learning, those involved in this field must understand how TTP can address and offer to enhance the digital competency of PSTs. As previously reported in the literature, national policies and institutional guidelines significantly impact the integration of digital tools in teacher education (Tømte, 2015). In Norwegian teacher education, this issue includes a lack of coherence between subject specific knowledge and pedagogical knowledge, which pose challenges for teachers, suggesting the ineffectiveness of the TTP (Hammerness, 2013). One reason for that is, student teachers get their content knowledge from their departments to some extent separate from the TTP, where the teachers acquire their pedagogical knowledge.

While there is an increasing awareness of the challenges with ICT integration in teacher education (mentioned in Tømte, 2015). Also, this could be due to failure on the student's part in not recognizing the real affordances of digital tools they are utilizing from various formal and nonformal practices. Another study investigated the impact of wiki integrated in the formal study course of a TTP to explain how PSTs perceive its affordance to attain specific learning outcome (Brox, 2017). This study revealed that although the PSTs adapted and mastered for example a wiki[7], they failed to realize the purpose or the service such a resource could provide for them as teachers. This situation demonstrates that although there has been progress in the competency of PSTs in integrating various digital tools, there are also limitations in acknowledging their own competencies, which poses a challenge for researching digital competence.

Summary

This literature reviewed above provides an overview of the different perspectives that can contribute to the development of PDC among PSTs. The literature highlights on innovative practices that have contributed to enhance digital competency among PSTs. One prominent idea is to indulge student teachers in innovative practices limited not only to their pedagogical courses, but that these must be related practice and explored throughout their subject disciplines. At the same time, the impact of institutions on the development of PSTs is a research area that is important but at a somewhat early stage against the significant proportion of academic's inquiry

[7] Wiki can be a website, database or online community that is managed by the users. In this example Wiki is used in the classroom as a collaborative tool by a group of students.

on studying digital competence and digital practices in classrooms. The reviews have also addressed other limitations, such as the students' own restraint in connecting their own everyday digital proficiencies to practical teaching. In the following, the above research may serve as a backdrop in the forthcoming enquiry of the development of PDC among a group of PSTs at UiO affiliated with the CoE, ProTed.

CHAPTER 3: BACKGROUND AND CONTEXT

After examining the academic side of technology integration in the classroom, we will explore the political and national efforts that facilitate the development of the PDC among teachers. This chapter touches upon the CoE and the TTP at UiO, providing a thorough contextual description and structure of the ProTed. The chapter latter extracts the implemented learning designs that are specifically connected with digital competency for PSTs.

3.1 Professional Digital Competency Framework for Teachers in Norway

The Norwegian Centre for ICT in Education published a Professional Digital Competence Framework for Teachers as a mechanism to improve teachers' digital competency (Helland et al., 2017). The framework targets both professional and practical implications of digital technologies for teachers. Apparently, this system is built on seven pillars: subjects and basic skills, the school in society, ethics, change and development, interaction and communication, pedagogy and subject didactics, and leadership of the learning process. Furthermore, the framework provides a detailed account of these seven entities regarding knowledge, skills, and competencies required of the teacher. Additionally, this framework addresses the role of schools in society, change and development, and various ethical considerations related to the teaching profession.

Figure 3.1 Professional Digital Competency Framework for Teachers (Helland et al., 2017)

Furthermore, the framework is concerned with aspects related to the digital competency of teachers and provides an extensive set of responsibilities connected to teacher's digital competency. Beyond this, the system is multifaceted and can guide institutions, educators, and training programs to comprehend the broader responsibility of teachers in using digital tools.

3.2 Development of Digital Skills in the Norwegian Landscape

In addition to the formal framework of the Professional Digital Competency for the Teachers in Norway (Helland et al., 2017), other national efforts have cleared a path for the smooth integration of digital tools in the education sector. The following policies and reforms provide a brief overview of the national efforts for the effective integration of digital tools in Norwegian classrooms.

3.2.1 Knowledge Promotion Reform

The Ministry of Education and Research and the Norwegian Directorate for Education and Training introduced a reform to recognize digital skills as a compulsory part of educational curricula from grades 1–13 (Norwegian Directorate for Education and Training, 2012). This reform was a response to the necessity for the students to develop digital skills and four other basic skills (oral, written, reading, and mathematical abilities) to adapt to the growing technological needs of society. This reform reflects the importance of developing teachers' digital skills with pedagogy and academic subjects to teach pupils using technology in Norwegian schools (Tømte, 2015). Moreover, the reform launched three national initiatives: the PILOT-program, the PLUTO-program, and The Learning Network Program (Tømte, 2015). The latter focused on introducing ICT as part of TTPs' curricula.

3.2.2 Framework for Basic Skills

The Framework of Basic Skills was devised by the Norwegian Directorate for Education and Training in 2012, forming the basis for the formulation and revision of the National Subject Curricula across Norway. The Norwegian Ministry of Education and Research (2006) defines the digital competence of the teacher as follows:

> The total competence of teachers and instructors consists of several components where professional competence, the ability to teach the subject, the ability to structure the learning activities and knowledge of assessment and guidance are central elements. Teachers and instructors must also have multicultural competence and knowledge on the

> different points of departure and learning strategies their pupils have. (Ministry of Education and Research, 2006, p. 5)

The main components of the digital competency of teachers identified by the Norwegian Ministry of Education and Research are integrating ICT in teaching subjects, integrating ICT as a pedagogical tool to enhance learning and assessment, and emphasizing the importance of teachers' digital skills over students' digital competency. In short, teachers must be digitally competent to successfully integrate ICT in their classrooms. This report also explores the five dimensions of digital skills: the operational use of ICT, acquisition and processing of digital information, production and processing of digital information, judgment, and the ability to communicate digitally (Ottestad et al., 2014). Moreover, in the published report "Digitalization strategy for the higher education sector 2017-2021" (Ministry of Foreign Affairs, 2018), the Norwegian government raised many concerns regarding the inadequate digital competency of Norwegian teachers. In this paper, the government actively debated the need to help teachers become digitally competent to meet the growing demands of the effective use of ICT in teaching and learning environments (Ministry of Education and Research, 2018).

3.2.3 National Curricula Regulations for Primary and Lower Secondary Teacher Education Program for Years 1–7 and Years 5–10

The Ministry of Education and Research published the current national curricula in 2010. These regulations apply to all teacher education programs taught in Norway to ensure the *"integrated, professional oriented and research-based primary and lower secondary teacher education programs of high academic quality"* (Ministry of Education and Research, 2010). These guidelines are explicit about the knowledge, competencies, and learning outcomes that must be facilitated by primary and upper secondary school teachers. Additionally, these regulations emphasize the following:

> [T]he primary and lower secondary teacher education programs are to provide the candidates with the sound academic and didactic knowledge and qualify them for research-based professional performance and continuous professional development. The education programs are to interact closely with the professional field as well as with the society of which schools are part. (Ministry of Education and Research, 2010)

The TTP can incorporate learning designs and formulate curricula to achieve the above-mentioned competencies by the PST. The curricula further portrays that there are 30 credits of “Pedagogy and Pupil related Skills” in the first, second, and third years, ensuring that the PST generates a broad knowledge of theoretical and practical integration of digital tools. Moreover, in the third year, future teachers must complete a thesis worth 15 credits related to “Pedagogy and Pupil related Skills.” Lastly, these candidates must accumulate 100 days of teaching practice in both primary and secondary schools to develop a comprehensive teaching experience.

3.3 Centres of Excellence

To implement the national initiatives, the Norwegian government heavily aided by the CoEs, which provide the foundations of research-based knowledge that guide and actively implement national policies. The Norwegian Centres for Excellence Initiative (CoE) were established in 2010 with the aim *“to stimulate teaching and learning excellence (and) research and knowledge-based research development of educational activities at bachelor and master level*” (Helseth & Bråten, 2018, p.3). The Norwegian government has introduced CoE as an instrument in universities and research institutes to enhance the quality of research, innovation, and education. In Norway, there are three types of CoE: the Centres of Excellence in Research (CoE-R), the Centres of Excellence in Higher Education (CoE-E), and the Centres of Research-based Innovation (CoE-I) (Keller, et al., 2015). The Norwegian criteria for joining the CoE is based on the capacity to produce and disseminate innovative and implement quality R&D development-based education in institutions of higher education. The CoEs aim to stimulate and drive cultural change, enhance knowledge and cooperation to disseminate this knowledge within institutions of higher education (Helseth & Bråten, 2018).

Next, this study focuses on the goals of CoE-E to enhance the quality of teacher education and strengthen teaching and research practices. The Norwegian Agency for Quality Assurance in Education (NOKUT) selects each of these centers for five years, which can be extended for another five years based on their evaluations, providing funding of 0.5 million Norwegian kroner per year. These CoEs engage in research relative to the programs at the host universities by engaging in R&D. Additionally, the implementation of this R&D can impact course organization and student satisfaction. That is, “*CoE-Es use knowledge accumulated through their R&D to*

make changes that increase relevance, reduce dropout rates and improves learning outcomes" (Keller, et al., 2015, p. 6). In these CoEs, the academics are also teachers at the host institutions, and they contribute to adopting, adapting, and implementing the most innovative practices in teaching to advance their student's learning experiences. Additionally, these academics provide their expertise in supervising students at undergraduate, graduate, and doctoral levels.

3.4 Department of Teacher Education and School Research

The CoE, ProTed is associated with the Department of Teacher Education and School Research in the Faculty of Educational Sciences at UiO. The emphasis of the department is to enhance subject didacticism and educational leadership in the field of teacher education. The department has been actively contributing to this research arena, examining groups such as the Challenges of Sustainability in Educational Research (Coser), Studies of Instruction across Subjects and Competences (SISCO), and the Teachers' Professional Development and Educational Change (TEPEC). Additionally, apart from ProTed the department has actively engaged with research centers, such as the following:

- **Teaching Learning Video-lab (TLVlab)**

This lab offers support and development in implementing innovative technology for teaching using audio or video recordings, such as livestreaming and video recordings of lectures and conferences. Furthermore, this unit also helps researchers in their projects to plan, collect, store, and analyze data, cooperating with other departments both within and apart from the university.

- **Nordic Centre of Excellence: Quality in Nordic Teaching (QUINT)**

The unit has a vision to investigate and increase teaching quality in Nordic countries by conducting video studies for grades 7–10. The main focus of this plan is to investigate the practice of digitalizing learning and teaching in the context of schools' multicultural profiles.

3.4.1 The Oslo Model

In this study, the context is limited to the TTP for PST targeting years 8–13 at UiO, part of the Department of Teacher Education and School Research at the Faculty of Educational Sciences at UiO. This department emphasizes research to sustain and develop teacher education, subject didactics, educational leadership, and school-based educational research. Additionally, the TTP closely collaborates with the CoE ProTed: Centre for Professional Learning in Teacher Education. The TTP comprises ten semesters with 30 credits each semester. Oslo Model represents the in-depth structure of the implemented at UiO. An overview of the Oslo Model is shown in the figure implemented at UiO.

University of Oslo Study design – Humanities (8-13)				Dimensions throughout the five year, integrated study design			
				Mentor Program (Promo)	Teaching practice in schools	Research methodology	Professional digital competence (PfDK)
10	Master thesis (Subject 1 **or** Subject didactic 1)			1 seminar + poster-conference	Poster conference with schools	Experience from scientific work Master thesis	Test mapping professional digital competence 3
9	Subject 1 **or** Subject didactic 1	Subject 1 **or** Subject didactic 1	Subject 1 **or** Subject didactic 1	2 seminars	**15** days: Empirical data collection?	Data collection + analysis	Digital learning module 4 (integrated SPOC)
8	Subject 1 **or** Subject didactic 1	Subject 1 **or** Subject didactic 1	Subject 1 **or** Subject didactic 1	2 seminars	R&D in schools	Research design + method	Test mapping professional digital competence 2
7	Professional course (Integrated Educational Theory and Subject Didactics)			2 seminars	**45** days : Assessment and differentiated instruction	Research methods + R&D exam assignment	Digital learning module 3 (integrated SPOC)
6	Subject 1	Professional course (Integrated Educational Theory and Subject Didactics)		2 seminars	**25** days : teaching, learning and classroom management	Research in schools + R&D exam assignment + digital video case exam	Digital learning module 2 (integrated SPOC)
5	Subject 1	Subject 1	Subject 1	3 seminars	Visits to different learning arenas (museums etc.)	Bachelor thesis	Technology in subject areas and research
4	Subject 1	Ex.phil	Subject 1	3 seminars	Schools visits, university schools	Specialization in subject area + Analytical skills	Test mapping professional digital competence 1
3	Subject 1	Subject 1	Professional course	3 seminars	**15** days : Pupils learning in different subjects	Systematic observation + Case analysis of pupils and teacher	Digital learning module 1 (integrated SPOC)
2	Subject 2	Subject 2	Subject 2	3 seminars	The role of the teacher	Professional insight in subject area + Critical thinking	Technology in subject areas and research
1	Subject 2	Subject 2	Subject 2	3 seminars	Schools visits, university schools	Professional insight in subject area + Critical thinking	Technology in subject areas and research
	10 ECTS	10 ECTS	10 ECTS				

Figure 3.2: The Oslo Model, displaying the study designs throughout the five-year Teacher Training Program (ProTed, 2017)

This figure shows the study design of this program and the dimensions of these study designs throughout the five-year TTP. The Oslo Model depicts the PDCM (PfDK) running throughout the five-year TTP, directly targeting the digital competency of the PSTs. Beyond this, the Mentor Program and Teacher Practice in Schools impact the development of PDC in the PST by providing opportunities to experiment and practice their digital competency. These study designs are

integrated coherently into the five-year TTP to help teachers confront future challenges in their professional lives.

3.5 ProTed as a Centre of Excellence in Norway

In this section, the extensive description of the operational structures and aims of ProTed are discussed to allow the study to grasp the learning experiences of PSTs. In Norway, ProTed was the first CoE-E established to contribute to innovative and research-based integrated study design in teacher education as a joint venture at UiO and The Arctic University of Norway (UiT) in 2012.

> ProTed serve[s] as a structuring space for systematic experiments in teacher education programs that integrate a strong research base and tight collaboration between the practice field and education based on a deep interplay between profession-oriented and scientific components. (Lund & Eriksen, 2016, p. 54, translated from NOKUT)

The vision of this Centre is to "*educate knowledgeable, confident, and internationally oriented professional teachers for a multicultural knowledge society."* In this case, the goal is to achieve *"research-based and integrated teacher education for knowledge-based practices at multiple learning arenas"* (NOKUT, 2015, p. 3). The organization's vision statement emphasizes content knowledge, pedagogy, and the theoretical and practical aspects connected to the teaching profession. Although this thesis focuses on the digital competency of PSTs, there is no clear reference to digital competency as part of the main objective of ProTed. Through deeper scrutiny of the operational schemes of the ProTed, one can extract various study designs that facilitate the development of digital skills of PSTs at UiO. Thus, the brief overview of the TTP at UiO is presented with the working packages (WP) of the ProTed that are implemented at UiO. Lastly, the study lists the most relevant study designs in the TTP that target the development of digital competence of PSTs.

3.5.1 Working Packages:

ProTed is structured in the form of five systematic WPs that are aimed towards providing coherent teacher education practices at UiO. The fig 3.3 illustrates the organization of working packages.

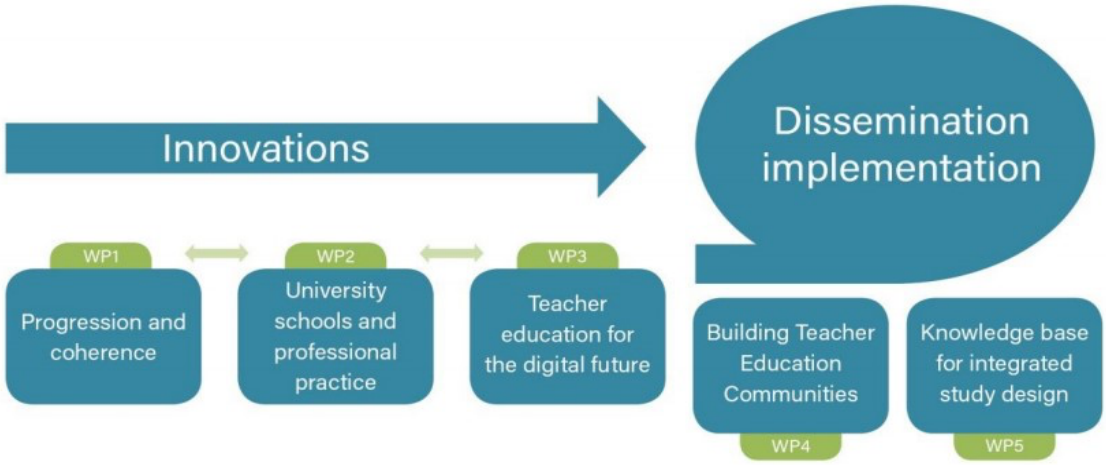

Figure 3.3: The Working Packages of ProTed. (Courtesy ProTed)

The first three packages are associated with the acquisition of innovative practices in teaching related to student-centered learning designs. Students profit from developmental projects that are integrated as learning designs for more innovative experiences during their formal study programs. The latter two working projects are embedded in the formation of educator communities and are involved in disseminating knowledge locally, nationally, and internationally. Additionally, the following WPs are condensed descriptions of Annual Reports from 2014 to 2019 (ProTed, 2014, 2015, 2016, 2017, 2018, 2019).

The WP1 focuses on promoting progression and cohesion by integrating academic subjects, professional courses, innovative pedagogical practices, and subject didactics to enhance teachers' professional competency (ProTed, 2014, 2015, 2016, 2017, 2018, 2019). At UiO, the formation of the Oslo Model has promoted coherence among the integration of academic subjects, professional pedagogical, didactic courses, and school practice in the five-year TTP. This promotion of coherence has been established by active collaboration between five faculties to develop didactical and pedagogical practices under the supervision of mentors, subject professors, and pedagogical experts. This practice helps the PSTs form their professional identities in the teachers' community.

Next, WP2 is based on the "University School Concept," which is praised as a "*jewel in ProTed's crown"* (NOKUT, 2015; ProTed, 2015, p. 3). This concept represents the partnership between local schools and the university to provide students with internships (school practice). This cooperation and partnership *"provide a fertile ground for integration theoretical as well as experimental learning"* (ProTed, 2014, p. 8). The central aim of this system is to improve TTP's quality by providing a practice dimension for the PSTs, facilitating two-way cooperation in research and developmental projects with partner schools (ProTed, 2014, 2015, 2016, 2017, 2018, 2019). Additionally, such partnerships have been beneficial for schools in disseminating research-based knowledge to improve the quality of school-based practices.

Beyond this, WP3 is related to developing and stimulating technology-rich learning environments to help PSTs comprehend the conceptual meaning of PDC and appreciate the affordances of digital tools. In the same vein, TTP incorporates many digital learning platforms and digital applications, including "Flipped Classrooms" and "MOOC-Like Platforms" to expand PST's potential. The latter can use digital resources for learning, communication, sharing, and experimenting to attain learning objectives. For example, small private online courses (SPOCs) were introduced as a single, mandatory course called Prof 1015, which aiming to develop professional identity and teaching competency with various digital tools. Similarly, the Video-based Mentoring in Practice Placement in Teacher Education also known as "*Videobasert veiledning av praksis I lærerutdanningen*," VVPL in Norwegian aims to provide student with the experiences of e-supervision and e-assessment by making videos using an app on the students' iPads (ProTed, 2015, 2016, 2017, 2018, 2019). These videos are later used for analyzing students' teaching skills and getting feedback from their peers, professors, and mentors. Digital exams are another form of assessment using digital tools in which the students evaluate a video based on real-life scenarios of teaching practices. In the digital exam the students are required to employ various digital resources to portray their pedagogical, subject didactical and digital knowledge. Thus, introducing digital exams has been adopted nationwide across Norway as a learning study design in TTP (ProTed 2016).

Additionally, as part of WP3, the TTP includes Digital Learning Modules in Professional Digital Competency (PfDK), which are offered in the third, sixth, and seventh semesters of the five-year teaching training program (ProTed, 2015, 2016, 2017, 2018, 2019). These modules encourage students to explore digital tools more specific to their subjects and explain the integration of technology in learning environments. Lastly, the host universities organize seminars and

workshops like “Innovation Seminar,” aiming to provide students and teachers with the knowledge about ICT in future classrooms.

The WP4 is related to building teacher educator communities on local, national, and international platforms to disseminate knowledge and encourage quality research. The main agenda of this WP is to integrate, manage, and implement research- and experience-based knowledge in teacher education (Annual Report 2014). In the Annual Report of 2015, WP4 was responsible for organizing educational leadership on several levels between UiO and UiT and between ProTed leadership and the host universities. The creation of new management and education leadership at the course coordinator level was aimed to enhance the quality of all levels in teacher education (Annual Report 2016). Furthermore, at UiO, the WP has strengthened science teachers’ competency by introducing a 30-point course that emphasizes the basic skills required to teach science, conceptual development, and assessment. The aim of this system is to develop a research-based teaching community and for pre-service and in-service science teachers to publish articles in scientific journals (Annual Report 2017).

The main focus of the WP5 is to establish high-quality, integrated teacher education. Thus, this system gives an overview of the innovative research-based knowledge from the developmental WP 1–4 in light of national and international research and developmental models providing direction for the TTP (Annual Report 2017). This WP captures the notions of progressions, integration, design, quality, and coherence. According to the 2014 annual report, the WP strives to develop quality indicators and build valid theoretical designs for students.

3.5.2 ProTed’s Research Focus on the Development of Digital Competency among Pre-service Teachers

To explain the impact the ProTed has on the development of the PDC of the PSTs, a brief overview is provided to show the Centre’s research focus. Therefore, this section highlights some of the main concepts and theories from the scientific articles published by academics from ProTed who emphasize the development and challenges related to the digital competency among the PSTs.

One of the core areas of research is based on the ‘design perspective’ used as an analytical tool for examining and transforming necessary activities in the TTP within ProTed (Vestøl, 2016). This

design perspective is inspired by the cultural-historical activity theory (CHAT) (Engeström, 1987; Engeström et al., 1999), the socio-cultural theory by Vygotsky (1980), and action research design (Argyris & Schon, 1978). These three concepts appear in publications where the socio-cultural perspective focuses on the artifacts for learning. That is, CHAT centers around transformative practices (drivers for change), and action research involves researching one's practices, such as how the ProTed researches the practices of their center.

Figure 3.2 illustrates the learning design and the teaching design, where PSTs interact with a subject, the object, and the mediating tools to develop their competency as teachers. According to this perspective, teacher's competence is managed as an educational object, where the PSTs use mediating tools for teaching and learning.

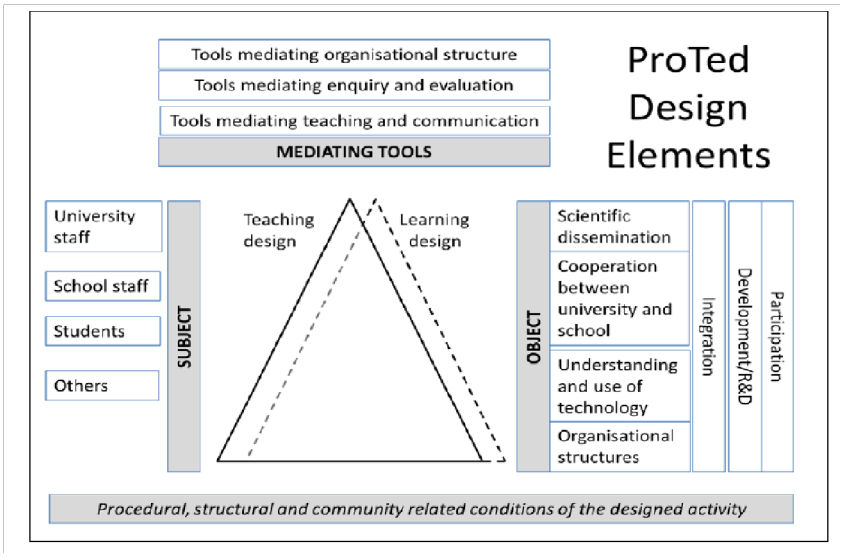

Figure 3.4: Design Perspective of ProTed (Vestøl, 2016)

This figure is inspired by Vygotsky's triangle of mediated action, composed of a mediating tool, object, and subject (Vygotsky, 1980). Similarly, this design creates a dynamic relationship between the object, subject, and mediating tools. The design perspective in ProTed translates as:

> In ProTed, the overall activity is a complex entity involving two teacher education institutions and a range of sub-projects that are activities in their respect but also contribute to an activity centered in the work of the ProTed leadership group. (Vestøl, 2016, p. 78)

According to the design perspective, design for teaching refers to a teacher's perspective, aims, competencies, and understanding of curricula and the learners. This system captures the essence of the policies and the institutional goals linked to designs for teaching. At the same time, design for learning refers to one's practical learning situation and the enactment of the learning activity.

It portrays the manner in which the teachers engage, and learners interact with the learning object. However, design for teaching is limited to the learning activity, whereas the design for learning is context specific. That is, learners can utilize cultural tools such as the internet or peer discussions to learn or reflect their learning. The relationship between the design for teaching and design for learning can be elaborated through the concept of *obuchenie* (Vygotsky, 1980), which simultaneously captures the double-sided process of teaching and learning.

Lund et al. used the design concept to explore the engagement of PSTs in the digital environment (2014). The study concluded that digital technologies fit under the category of artifacts that have the transformative potential, which according to the CHAT approach *"allows for transformation by theorizing the relationship between the agents and the artefacts while taking institutional dimensions into consideration"* (Lund, Furberg, et al.,2014 p.96). Another study also emphasized that the design approach is an essential element that can enhance teacher education quality, especially developing PDC among PSTs (Lund, Bakken, et al., 2014). Thus, this approach is used to construct digital learning environments and provide design for PSTs for both learning environments and learning trajectories in increasingly complex digital learning situations.

Furthermore, the concepts of transformative agency and double simulation are some of the leading frameworks used to investigate students' abilities to become confident and competent teachers (Lund & Eriksen, 2016b). The basic notion of transformative agency has been applied to investigate how agents (PSTs or educators) choose between alternative resources, and encounter dilemmas in various situations to be more productive. This concept involves recognizing the problem and then strategically employing various recourses to solve it. The basic notion of transformative agency comes from Vygotsky's social psychology, but it has since been used to explain systemic levels and organizational change (Lund & Eriksen, 2016). Such scientific studies portray the active research focus of the academic of the ProTed in transforming the PSTs' digital skills to cope with rapidly evolving learning environments.

3.5.3 Main aims and objectives

The ProTed working packages have a vast array of expertise. However, for this research study, the focus is on the WPs implemented at UiO that directly or indirectly targeted to enhance the PDC of PSTs. This includes the TTP's integrate academic subjects, subject didactics, pedagogy, and theoretical and classroom practices to enhance the professional competency of PSTs. Additionally,

the ProTed closely collaborates with TTP and seamlessly integrates and formulates the study designs in Oslo Model that are implemented at UiO.

The table 3.1 illustrates the innovational study designs that have been initiated by the ProTed and were implemented at UiO before 2019, ensuring active student engagement from most of the student body in TTP. These study designs provide the basis for developing the interview guide in the current study to ensure a connection between the program and the PST's experiences during their formal training. Furthermore, the selected study designs could have a potential significance on the development of PSTs' digital competency.

Innovational study designs	**Aims for integrating the study design**
Mentoring Program	The mentors guide the PSTs during their teacher practice or internships, supporting the formation of the PSTs professional identities. It provides PSTs with mentors whose experience and insight expand PSTs knowledge in integrating digital tools into subject didactics and pedagogy.
University School Concept Teacher Practice	It provides PSTs with school-based practicums to help them incorporate digital tools into their classrooms. Additionally, the classroom practicum allows PSTs to link theory and practice using their theoretical knowledge of pedagogy and technology and content. This system aims to provide PSTs ground for empirical research for their thesis and valuable opportunities to practice innovative pedagogical knowledge. The learning design aims to improve the quality of TTP by *"creat[ing] good models for practice experiences for teacher education students"* (ProTed, 2019, p. 8).

Flipped Classroom and Learning Management Systems (LMS)	Professors and leaders have designed modules to provide the PSTs the experience of Flipped Classroom setup. All courses at the teacher education program are now supported by and centered around Canvas, and several digital resources have been developed to enhance student understanding of the various topics in the teacher education program (ProTed, 2018, p. 13). Additionally, LMS and Flipped Classrooms highlights the value of digital online systems, which PSTs use to collaborate, communicate, organize, and upload assignments, connecting instantaneously with their peers, teachers, and the administration.
Video-based Mentoring in Practice Placement in Teacher Education (VVPL)	At UiO, video-based assessment has been employed for a long time and was developed over the course of seven years. The VVPL is an innovative learning design created to improve the quality of supervision during PSTs' school practice by recording the PSTs' teaching sequences. Projects like CLARE (Classroom Application for Reflection in Education) provide more efficient ways to recording videos for teacher's reflection and supervisions. The project claims to build the PDC of the PSTs (ProTed, 2018). According the 2019 Annual Report, the DIVA (Digital Integration of Video evaluation) project has incorporated the VIVA (Visual Vocal Application) app for recording data with privacy standards up to GDPR regulations (ProTed, 2019). The DIVA project claims to transform formative and summative assessments through the production of digital video recordings, which are later used to assess PST's teaching practices during their internship. These videos are key in merging learning activities on campus and in teacher practice. This digital learning design contributes to developing the PDC of the PSTs.
Digital Exams	Digital Exams are another form of exams that require the PSTs to analyze a video using their pedagogical, theoretical and didactical knowledge. The scientific journals published by the academics from ProTed examines the challenges confronted by the PSTs with the growing integration of digital tools in their learning environments. The article explained the digital exams through the "*concept of design as both an analytical and a didactic concept that links technology-rich environments and learning trajectories to knowledge development"* (Lund, Bakken, et al., 2014). This article claimed that digital exams contribute to enhancing the quality of TTP and the PDC of PSTs.

Professional Digital Competency Module (PDCM)	The module promotes digital learning environments on campus and assists in the integration of digital tools in professional subjects studied in the 3rd, 6th, and 7th semesters by each PST in the five-year TTP. The module integrates Canvas and other technological learning activities to encourage students to further explore and experiment with digital tools for teaching and learning. Additionally, this study explores the experiences of PSTs regarding the integration of the module that targets the development of their PDC.

Table 3.1: Innovational Study Designs from ProTed

In summary, the above-mentioned learning designs are taken from the working packages of the ProTed that targets to enhance the quality of TTP, especially the PDC of the PSTs. These main learning designs have inspired the formulation of an interview guide, forming the basis of the areas explored in this thesis. Furthermore, these learning designs resonate with the aims of ProTed that prepare digitally competent teachers by introducing study design, modules, and curricula that make PSTs aware of the theoretical concepts, practical usage, and real affordances of using digital tools.

CHAPTER 4: ANALYTICAL FRAMEWORK

The literature review of this thesis is pointing towards a set of aspects that appears to be important in facilitating PSTs in better equipping themselves with the skills needed to implement technology and digital teaching practices in their classrooms. With national efforts and TTPs at the institutional level enforcing and upgrading the curricula to develop the digital competency of PSTs. This study aimed to investigate a similar case to the cases mentioned in the literature review, examining the alignment between the CoE with the experiences of the PSTs' PDC development. To measure the PDC, the study analyzes the experiences of the PDC by using a two-dimensional framework capturing the PSTs' awareness of and proficiency integrating digital tools in their classrooms.

4.1 Teacher's Digital Competence Model

The national framework of Professional Digital Competency Framework for Teachers, as mentioned in Figure 2.1, illustrates the segmented entities related to the PDC that are vast to capture for an in-depth study (Helland et al., 2017). In addition to the ProTed design elements (mentioned in Section 3.4 and illustrated Figure 3.4) that builds on the concept of design for teaching and design for learning, depicts the process of how the PSTs interact with subject, object, and mediating tools in their learning environments (Vestøl, 2016).

However, in this thesis, The Teacher's Digital Competence Framework is selected as an analytical tool to scrutinize the experiences of the PSTs. This framework portrays different levels and stages of digital competency related to the awareness and practical proficiency that can be applied to measure the development of digital skills of PSTs. Krumsvik (2011) defined digital competency for educators as follows:

> Digital competence is the teachers/TEs' [teacher educators'] proficiency in using ICT in a professional context with good pedagogic-didactic judgment and his or her awareness of its implications for learning strategies and the digital *Bildung* of pupils and students. (p. 44–45)

This definition clearly distinguishes the technological skills, proficiency, and awareness of teachers from those in other professions, as these competencies are embedded in professional

perspectives on acquiring digital skills. Additionally, this definition portrays teachers as role models because they practice their pedagogical and didactical judgment in their learning environments. Furthermore, the definition also refers to the awareness of both integrating innovative learning strategies and expanding awareness of the ethical and moral values connected to the use of digital tools. Beyond this, PDC is far more than just acquiring expertise in technical tools. For instance, it requires the *"intersection of both cognition, perception, metacognition, motor skills, learning strategies, self-efficacy, and pedagogic-didactic aspects"* (Krumsvik, 2008, p. 284). Furthermore, this model stresses the distinct nature of the teaching profession and educators' digital engagements, as it has become a requirement for teachers to develop PDC.

Rune Johan Krumsvik developed Teacher's Digital Competency Model based on empirical research in the Norwegian context. This model has been introduced in many of Krumsvik's scientific studies, but there is an inconsistency throughout this work in the names given to the model. That is, this model has been called "Teacher Educators Digital Competence" (Krumsvik, 2014); "Teacher's Digital Competence Model" (Krumsvik, 2014; Krumsvik et al., 2016); and the "Model for Digital Competence for Teachers and Teacher Educators" (Krumsvik, 2011). Hence, in this study, the model here is called the "Teacher's Digital Competence Model" and is used as an analytical tool to study how teachers develop their digital competency within their profession.

The model in this study represents the journey of the PSTs to achieve a higher level of PDC. The following figure 4.5 presents the diagram of Teacher's Digital Competence Model. The model contains four core components: basic digital skills, didactic ICT-competence, learning strategies, and digital Bildung, representing the stages or the aspects of PDC. The horizontal and vertical axes of the model embody the four stages of adoption, adaption, appropriation, and innovation, which represent the practical proficiency and self-awareness aspects of integrating digital technology for teaching in the classroom.

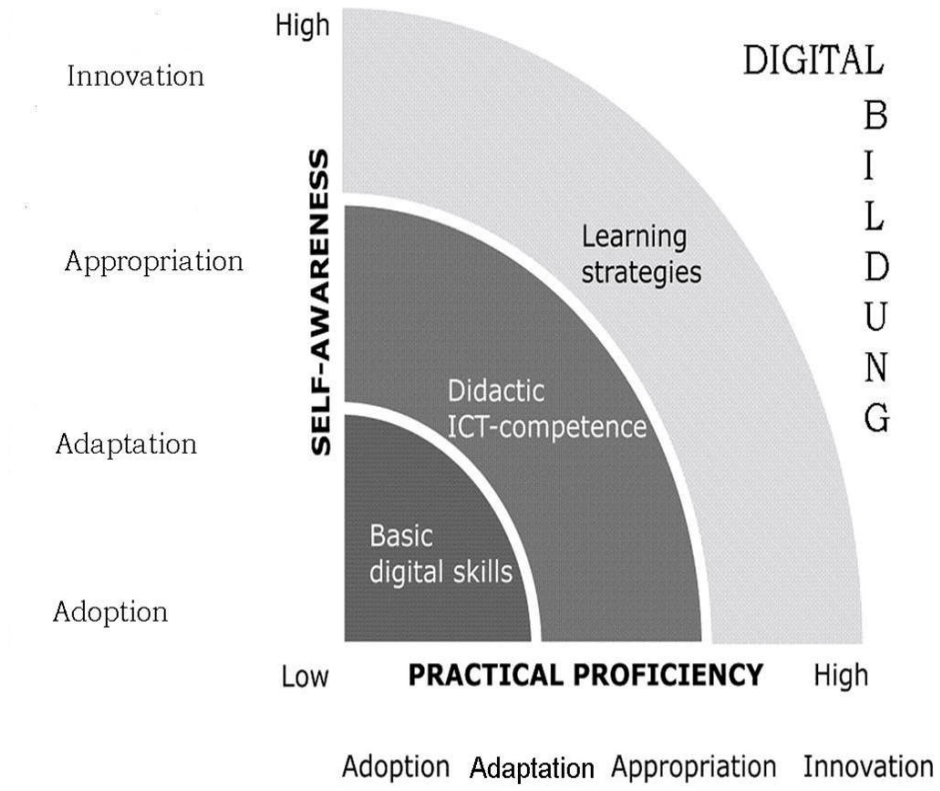

Figure 4.5: Teacher's Digital Competence Model proposed by Krumsvik (2012)

The Model of Teacher's Digital Competence conceptualizes the interaction between the "mental digital competency journey," denoted as self-awareness on the vertical axis, and the "practical competency journey," marked as practical proficiency on the horizontal axis (Krumsvik, 2008, 2011a, 2012). According to Krumsvik, the theoretical foundations of this model were inspired by the previous studies of Apple Classrooms of Tomorrow (Dwyer, 1991); socio-cultural learning theory (Säljö, 2001); distributed cognition (Hutchins, 1995); tacit knowledge (Polanyi, 1966); reflection-in-action (Schön, 1983); and situated learning (Lave & Wenger, 1991a). Furthermore, *"the essence of the model is that cognitive processes are continuously offloaded to digital artifacts when we are using computers and that this kind of learning is situated everywhere in today's digitized society"* (Krumsvik, 2014, p. 275). In this work, Krumsvik's aim was to capture how teachers employ digital tools in their classrooms to teach certain subjects.

In the following section, we will explore in detail the notions that constitutes the PDC of the PSTs. This section examines these concepts and their mental and practical journeys that need to be attained simultaneously.

4.2 Basic Digital Competency

The basic digital skills reflected in schools' national curricula represent a set of skills required to use digital tools for leisure, social media, and basic teaching tools, such as office tools, email, LMS, and tablets. Additionally, basic digital skills are regarded as the compulsory skills attained during the formal education of PSTs. In the current digital environment, PSTs are engaged with technology outside educational boundaries and learn a basic level of ICT skills before entering teacher education. Students generally use basic digital skills to compose assignments, take online exams, and use LMS in schools and universities. Additionally, the TTPs are formulated to develop the PDC and considers the PSTs´ basic skillsets.

4.3 Didactic ICT-Competency

The second component of the model is "Didactic ICT-competence," which requires a teacher to use digital tools or computer-assisted pedagogical tools for subject-specific content. This component resonates with Shulman's (1987) idea of pedagogical content knowledge (PCK) and Mishra and Koehler's (2006) technological pedagogical content knowledge (TPACK). These studies assert the importance of a teacher's ability to incorporate subjects, pedagogies, and digital competence simultaneously in their teaching. At this stage, as Krumsvik explained, ICT skills are incorporated with subject didactics and pedagogical skills, which *"puts epistemological aspects in the 'front seat' and technological artifacts in the 'back seat"* (Krumsvik, 2008, p. 285). At this stage, the emphasis is given to the epistemological part of the technology.

In this framework, digital tools are seen as cultural instruments that needs to be transparent for the PSTs. The notion of transparency of these tools comes from the work of Lave and Wenger (1991). Transparency of the digital tools refers *"to the ways in which using artifacts and understanding their significance interact to become one learning process"* (Lave & Wenger, 1991a, pp. 102–103). Additionally, these researchers link epistemological implications with the concepts of transparency and access by saying that *"in focusing on the epistemological role of artifacts in*

the context of the social organization of knowledge, this notion of transparency constitutes, as it were, the cultural organization of access" (Lave & Wenger, 1991a, p. 102). This quotation suggests that the artifacts (digital tools) are more than just tools; they also have epistemological roles specific to their subjects within their social and cultural contexts.

This ICT didactics on the theoretical framework's vertical axis reflect self-awareness or the mental digital competence journey. Krumsvik explains the distinct digital competence of the teachers which is specific to their profession.

> This double dimension involves didactic ICT competence, which is similar to other occupations, but at the same time, it distinguishes itself because TEs (Teacher Educators) are preparing student teachers for both a certification in academia (summative assessment, exams) and future practice in the field. (Krumsvik, 2014, p. 277)

In other words, teachers become role models for their students first by inculcating the "teach as they preach" principle. Second, a teacher must understand the distinct nature of the teaching profession, which requires active judgment to incorporate digital tools and expand learning possibilities in classrooms. This self-awareness requires guidance from the TTP and colleagues, who raise teachers' awareness of the diverse uses of digital tools for teaching and learning. The self-awareness increases teachers' abilities to understand and recognize the affordances of digital tools in classrooms. According to the Education Act and the national curriculum, the didactic use of ICT is a mandatory competence for teachers.

This study explores how PSTs consider their developing of digital competence, which is related to their subject-specific digital tools, innovative platforms and online examination forms. The notion of ICT digital competence helps one to explore how PSTs develop their skills by incorporating digital tools that are specific to their subjects and how these teachers learn and practice both classic and more advanced didactic digital tools. In turn, the experiences of these teachers give them opportunities to learn, expand, and experiment with their pedagogic-didactic judgment related to the incorporation of the digital tools.

4.4 Learning Strategies:

The third component of the model, “learning strategies,” corresponds to a new pedagogical landscape that is an essential component of PDC. This statement implies that:

> TEs (Teacher Educators) must utilize student teachers’ basic digital skills and maintain a strong focus on the metacognitive aspect to learn and practice their knowledge of digital tools. The latter enables student teachers to delve deeper into the pedagogical use of ICT as an entry point for developing new learning strategies (Krumsvik, 2014, p. 277).

It suggests more focus on the pedagogical implications as part of teacher’s own professional development by integrating various digital tools. Additionally, teachers are expected to use multi-modal, high-end digital teaching resources, integrating learning strategies into digital forms to develop critical skills among students. Learning strategies are seen as pedagogical advancements, integrating new approaches to teaching and learning with the capacity to uphold planning, teaching, and other significant aspects like assessments of proficiency in the use of digital resources (Krumsvik, 2011b). This endeavor also demands a clear focus on the subject within a digital learning environment so that teachers exhibit their confidence in utilizing digital tools. Beyond this, teachers must possess authority over the form and content of the technologies they present in their classrooms. Furthermore, in the vast realm of digital tools, PSTs should be aware of how to integrate digital tools for scaffolding, knowledge construction, and metacognition.

With the learning designs integrated by ProTed in the TTP that are aimed to contribute towards the understanding of digital tools for assessment, feedback and various new learning strategies to achieve pedagogical outcomes. It also includes the ‘flipped learning’ experience where the teachers integrate LMS to provide learning resources for the students and guide the students remotely. It also points to the ‘double dimension’ as mentioned by Krumsvik (2014) where the teachers model the use of digital tools and engage student in the process of learning using digital tools. Similarly, with the use of digital assessment and learning via digital tools, the teachers contribute to introducing and expanding students’ digital competency by engaging the students with digital tools that are part of their digital learning environment. To attain and practice learning strategies, the PSTs needs to be aware of theoretical understanding and practical proficiency in composing digital questionnaires, assessments and learning resources so that students can participate to exhibit their knowledge in their digital learning environments.

4.5 Digital *Bildung*

The fourth and final component of the model is "Digital Bildung" or techno cultural *Bildung*. On this subject, Krumsvik explained the following:

> Digital Bildung [digital danning in Norwegian] focuses on how the digitization of society influences pupils' participation, their multi-membership of different communities, social media, and identity development in the digital era. Digital Bildung also portrays the ethical and moral reflections on technology's role in human development. In school settings, this implies the need for both teachers and pupils to develop ethical competencies in the critical use of sources, as well as an ethical awareness of the social implications of living in a digitized society and school. (Krumsvik, 2011b, p. 47)

As pointed out by the statement, digital Bildung is linked to the awareness of ethical considerations, social implications, and the effect of digital tools on a student's digital development. This last stage portrays the metaperspective of digital competency by combining the competency of the previous three stages i.e., basic, ICT-Didactical and Learning Strategies. The holistic perspective enables the teachers to understand the learning perspective in a digitalized society. With regards to the PSTs in Norway, their active digital engagement on social media and technologies impacts the development of their *Bildung*, as these PSTs can be referred to as 'digital natives'. This stage portrays the perceptions of teachers regarding the role of digital media and tools for the purpose of education. Additionally, this not only requires PSTs to be skillful and conscious but also be socially aware of the moral values ethical pitfalls of integrating digital tools (Røkenes & Krumsvik, 2016).

4.6 Adoption, Adaption, Appropriation, and Innovation

The concepts of adaption, adaption, appropriation, and innovation are located on the *x*-axis and the *y*-axis of the Teacher's Digital Competence Model, as shown in Figure 3.4. The horizontal and vertical dimensions of adoption, adaption, appropriation, and innovation for self-awareness and practical proficiency portrays the competence level among the teachers. Krumsvik translated these concepts into tacit knowledge, know-how, knowing, and awareness (Krumsvik, 2008, 2014).

The first two stages of adoption and adaption mostly involve handling basic digital tools where digital tools are not transparent or comprehensible for the PST. Additionally, these stages are concerned with mental awareness and overcoming obstacles that have prevented the teachers from using or experimenting with digital tools.

This idea leads to the third stage of appropriation, where the teachers are able to show their mastery of incorporating digital tools. At this stage, the PSTs should have a solid foundation for using and recognizing digital tools, reflecting the invisibility of these tools. According to Lave and Wenger, for a learner to attain competency in using digital tools, these tools must become transparent so that where the "black box can be opened, it can become a 'glass box'" (Lave & Wenger, 1991b, p. 102). In other words, a teacher must understand the potential of digital tools and have the skills necessary to integrate these tools for their pedagogical purposes. Drawing from Lave and Wenger's (1991) work, the third and fourth stages of appropriation and innovation reflect a teacher's authority, where the teacher recognizes the value of the invisibility of digital tools. "*Invisibility of mediating technologies is necessary for allowing focus on and thus supporting the visibility of the subject matter. Conversely, the visibility of the significance of the technology is necessary for allowing its unproblematic—invisible—use*" (Lave & Wenger, 1991, p. 103). At this stage, teachers are not interrupted by obstacles and have more control over the potential of the digital tools.

Beyond this, Krumsvik related the notion of the invisibility of digital tools to the concepts of real affordances and perceived affordances, as proposed by Kirschner, Martens, and Strijbos (2004). These real affordances reflect a PST's ability to recognize and utilize these technologies to their full potential in teaching. In contrast, the perceived affordances reflect the PST's inability to recognize and utilize available technologies to their fullest potential in the classroom. Thus, Krumsvik asserted the following:

> [T]he pedagogic implications of this are that the TE [teacher educators] has reached the stage of recognizing the real affordances and is permitted to use his or her professional competence and authority in a way that is not interrupted by technical obstacles or form over content. (Krumsvik, 2014, p. 276)

At this stage, PSTs recognize and utilize the potential of their available digital resources. Finally, the innovation stage stands on the highest level of both self-awareness and practical proficiency.

At this point, *"the teachers are able to develop both pedagogical and didactic innovations by using ICT in teaching in a creative way, which also implies their ability to redesign and develop digital artefacts"* (Krumsvik, 2011a, pp. 47–48). That is, teachers are expected to innovate by redesigning and developing the digital tools according to the needs of their lesson plans. This stage enables teachers to use their ICT abilities to designing educational resources for teaching, assessing, and attainting the relevant educational outcomes. This stage marks the achievement of autonomy for the PSTs in extending and modifying the digital educational resources into more practical, current versions.

Another perspective related to the above-mentioned adoption, adaption, appropriation, and innovation is Wertsch's concept of mastery and appropriation of cultural tools (Røkenes, 2016). According to this concept, the first two stages of adoption and adaption refer to mastery, suggesting knowledge of how to use digital tools, whereas the last two stages, appropriation and innovation, refer to *"the process of taking something that belongs to others and make it one's own*" (Wertsch, 1998, p. 53). At the mastery stage, PSTs indulge in the process to attain self-awareness and practice utilizing digital tools. At this stage, the PSTs are unsure of the affordances of digital tools in the classroom. The PSTs' progress from appropriation to innovation demands that they comprehend the utility and affordances of the digital tools and integrate these tools not in a conventional manner but by extending the practical implications of the tools. Additionally, the PSTs' self-awareness gives them confidence to see the potential and affordances of the digital tools.

In this study, the sample represents the PSTs who are still in the last years of their TTPs. These PSTs' experiences with digital tools are limited to their university campus-based learning and their teaching practice of 100 days. Thus, these PSTs may have adapted the use of digital tools in the classroom, but the stages of appropriation and innovation relate to a rather advance level of their understanding and recognizing the potential and affordances of these tools, which may be harder to find indications of in the current study.

4.7 High and Low Dimensions

The Teacher's Digital Competence Model consists of two axes: the horizontal axis represents practical proficiency, and the vertical axis represents self-awareness. These factors are measured

on a scale from low to high, showing the intensity of the self-awareness and practical proficiency among the teachers. Krumsvik explained this notion by stating that the *"categories 'high' and 'low' in the model are drawn from Rosch and Lloyd's concept of 'superordinate level,'"* which is the superior level of the category (Rosch & Lloyd, 1978, stated in Krumsvik, 2014, p. 274). That is, these categories are superior to simple distinct notions of "high" and "low." Again, in the framework, the low end does not simply denote an incompetent teacher, nor does the high end automatically indicate a competent teacher. Instead, this measurement involves the synthesis of high self-awareness and high practical proficiency with the four notions in the middle of the Teacher's Digital Competence model to become a digitally competent teacher. This idea resonates with the aim of this thesis, where the PDC of the PSTs are not denoted by high or low, with these concepts instead providing the necessary markers to evaluate how the PSTs are developing to achieve a higher standard of digital competence.

4.8 Significance of the Framework

Again, the Teacher's Digital Competence Model is significant in investigating Norwegian PSTs. First, this framework has been used to define digital competency in the General Plan for Teacher Education in Norway (Krumsvik, 2011). Second, this framework tends to bridge the gap between the macro-level policies formulated at the national level with the new curriculum integrated by the institutions at the meso level to enhance the individual student's digital competency. Third, the model aligns with the policies, national curriculum, reports, working papers, reforms in Norway and can be used to evaluate digital competency in Scandinavian countries with similar education systems. Lastly, this paradigm connects the socio-cultural learning perspectives with the Norwegian educational context, policies, and guiding documents (Røkenes, 2016). Thus, this framework provides a valuable blend of national context and theoretical foundations.

Summary

The Teachers' Digital Competence Model has been widely applied as an analytical tool to understand the educational policies at the national and international levels in the Scandinavian and Norwegian contexts (Krumsvik, 2011, 2014; Krumsvik et al., 2016). However, in this thesis, the framework is used as an analytical lens to evaluate the experiences of the PSTs in developing their PDC in teaching. Today, students are digitally more active and aware of social media and diverse

sets of applications for navigating, shopping, entertainment, and so forth. By observing the young generation, one can infer that PSTs today are mentally aware and practically proficient in basic digital skills. Thus, a PST's most basic concern is to develop in the areas of ICT-didactics, learning strategies for digital Bildung. Empirical studies based on the Norwegian context demonstrate that the obstacle for PSTs developing high digital competency is a lack of opportunities to engage with innovative digital tools (Røkenes & Krumsvik, 2016). The model is best suited to this study because it captures both the self-awareness and the practical proficiency of PSTs about the integration of digital tools for didactical, pedagogical and as learning strategies. The Model also captures how the PSTs develop their digital identity by also acknowledging the social and cultural issues related to the integration of digital tools.

CHAPTER 5: METHODOLOGY

This chapter describes the methodology used in this thesis. The case study presented here is explanatory in nature, designed to explain the impact of the CoE ProTed on the experiences of PSTs during their TTP. Figure 5.6 displays the sequence of this thesis by aligning the main approaches used to investigate this study.

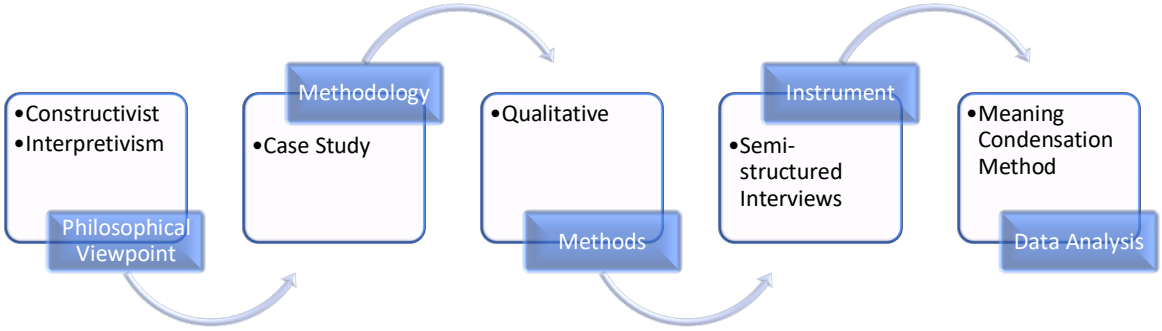

Figure 5.6: Research Design of Thesis

This study's philosophical viewpoint involves constructivism and interpretivism that support the qualitative nature of this case study. The latter employed qualitative methods to collect data in the form of semi-structured interviews, later analyzing the data through the meaning condensation method proposed by Brinkmann and Kvale (2015). Because the research problem focused on the PSTs' experiences, the qualitative approach seemed the most appropriate way to conduct this research.

5.1 Research Paradigm

This research takes interpretivism as an epistemological consideration and constructivism as an ontological one. In this vein, Gary Thomas (2016) portrayed interpretivism by comparing it to a stage drama where the researcher believes that *"there is no 'objective' social world"* out there, but this idea *"is constructed differently by each person in each situation they face, so it is useful sometimes to see the world as a stage on which we play out characters"* (Thomas, 2016, p. 52). That is, the social world is seen and experienced by each person in a different way; thus, the *"social scientist* [tries] *to grasp the subjective meaning of social action*" (Bryman, 2016, p. 26). The action occurs when people interact with other people, situations, or events and construct their

own meanings of those entities. This epistemological perspective examines the social world rather than objective variables for investigation. For this reason, the researcher must investigate and analyze a phenomenon through *"the meaning that people are constructing of the situations in which they find themselves"* (Thomas, 2016, p. 204).

Again, this study takes a constructivist approach as its ontological consideration. This paradigm reflects that the meanings are constructed socially, culturally, and historically (Bryman, 2016; Creswell, 2003, 2014; Creswell & Poth, 2017). This social constructivist approach arises from Vygotsky's work, suggesting that humans do not passively receive information but instead actively construct meaning according to their own experiences (Vygotsky,2001). According to Creswell, the following is true:

> Social Constructivists believe that individuals seek understanding of the world in which they live and work. Individuals develop the subjective meaning of the experience's meanings directed towards certain objects or things. The goal of the researcher is to rely as much as possible on the participant's view of the situation being studied. (2014)

Additionally, this study focuses on the experiences of PSTs in acquiring digital competency through formal training in their TTP. This research presented the experiences of PSTs constructed in their social settings along with their understanding and beliefs about teaching with technology, while enrolled in an institution that is affiliated with the CoE ProTed. The social constructivist stance is generally connected to qualitative research based on the perspective of reality (Jonassen, 1991) and aligns well with the notions of mastery and appropriation concepts from Wertsch (1998) and Krumsvik (2012) which I previously have presented in Section 4.6 as analytical grounding of the thesis. Beyond this, the constructivist approach coupled with the interpretive perspective provided the philosophical position on which this study was constructed.

5.2 Case Study

A case study was used as the methodology in this thesis, focusing on an intensive study on a single unit at a particular time (Bryman, 2016; Creswell, 2014; Yin, 2014). The exploratory nature of this thesis resonates with the following definition of the case study method:

> Case study is an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program, or system in a 'real life' context. It is research-based, inclusive of different methods and is evidence-led. The primary purpose is to generate an in-depth understanding of a specific topic, program, policy, institution or system to generate knowledge and inform policy development, professional practice and civil or community action. (Simons, 2009, p. 21)

The case study in this thesis examined a group of PSTs at UiO, and the aim is to investigate their development of digital competency during their five-year program. In this case, the PSTs are the subjects or the units of analysis, while the analytical framework is the analysis of the PSTs' development of PDC using Teacher's Digital Competence Model by Krumsvik (2014) in this specific institutional setting. Thus, this case study has a subject and analytical frame that forms the basic constituents of any case study (Thomas, 2016). Thomas defined case studies as *"analyses of persons, events, decisions, periods, projects, institutions, or other systems which are studied holistically by one or more methods. The case that is the subject of the inquiry will illuminate and explicate some analytical theme, or object*" (2016, p. 23). In other words, a case study aims to highlight a singular in-depth investigation by exploring an analytical theme within a specific context. In case study research, the boundary or context is significant, providing the direction of the study. In this study, the aim was to explore the PSTs' digital competency by exploring their experiences using the Teacher's Digital Competence Model.

In this study, there was only one unit of analysis and a single source of data collection: interviews. The unit of analysis chosen for this research was the TTP offered at the UiO. This program covers teacher training at both the undergraduate and graduate levels. The rationale for selecting this program at the UiO was its close affiliation with ProTed, an excellence center for teacher training in Norway. Furthermore, UiO as a case study was convenient because as a student at UiO, I could easily contact the participants and administration for information and data. Finally, this unit of analysis was an apt choice because it aligned with the theoretical concept of this study to investigate the experiences of PSTs developing their digital competency.

5.3 Sampling

Sampling involves a set of participants chosen from a larger population; in this case, PSTs represented *"a portion that shows the quality of the whole"* (Thomas, 2016, p. 63). The sampling procedure involves selecting the subjects of the study, and the sampling process indicates the researcher's intentions by targeting a specific population for the research (Miller & Salkind, 2002). For instance, this study was designed to incorporate purposeful sampling, but due to COVID-19 restrictions and regulations, I was compelled to adapt a simpler form of nonprobability sampling technique, known as "convenience sampling." Bryman (2016) illustrated that researcher choose convivence sampling merely because it is conveniently available. In this sampling procedure, participants volunteer to take part in a study and the aim is to deliver relevant data about the case under investigation (Jager, Putnick & Bornstein, 2017). Therefore, the researcher in this study considers the potential bias or the underrepresentation of the initial intended sample before drawing any conclusions.

To investigate digital competency, this research included only PSTs in their fourth or fifth years from the TTP at UiO. The rationale for selecting these students from the last two years of their TTP is to obtain their perceptions on the various learning designs and internships that are spread across the course of five years. To create an in-depth study with a nonprobability convenience sampling, this research further specified a particular sample using criteria sampling. The selection criteria for recruiting the PSTs were based on the following requirements:

1. The participants must either be in their fourth or fifth years if they are doing a five-year master's program or in their last year of a master's degree.
2. The participants must be enrolled in a TTP at UiO.
3. The participants must have completed more than half of their fieldwork.

After receiving approval from the Norwegian Centre for Research Data (NSD), I emailed the administration at the TTP with the attached file, which could then be forwarded to the PSTs to participate in this study. However, this method did not produce any participants. Furthermore, with the COVID-19 outbreak, it was not possible to contact the participants physically and instead used Facebook pages of student villages[8] to recruit participants. These efforts included posting an

[8] Student villages are the small colonies of student housing built by The Foundation of Student Life is a student welfare organization in Oslo and Akershus, Norway, established in 1939. The small student villages have Facebook groups as a channel to communicate.

advertisement specifying the criteria for the sample and providing a brief introduction of the research study. Finally, eight respondents offered their informal agreement and provided their email addresses to receive further information about the study, in accordance with the instructions and protocols suggested by the GDPR. All those who agreed to be participant then received an email with an information letter, a consent form, and a link to Calendly[9] to reserve dates for their Zoom interviews.

Calendly helped the researcher design a pre-questionnaire regarding participants' background, main teaching subjects, the years they started their TTP, the years they would finish their TTP, and lastly, if they had any experience of ICT in their university or workplace before starting their TTP. The following table 5.2 shows the participants' answers to a pre-questionnaire from the six respondents who agreed to participate in the interview.

Respondent	Age	Started Year	Year	Main subjects	ICT in college	ICT related job experience
Rosy	26–30	2015	Finished in 2020	English, Norwegian	Yes	No
Alice	20–25	2016	5th	English, Norwegian	No	No
Rina	26–30	2015	5th	English, Norwegian	No	No
Jess	31–35	2014	5th	English, Norwegian	No	No
Anna	20–25	2016	4th	Physics, Math	No	No
Jenna	35–40	2015	Finished in 202	German, Religion	No	No

Table 5.2: Overview of Study Participants

[9] Calendly is an online tool (web application) that is used to arrange and schedule meetings. My aim was to schedule the online zoom meetings with the participants.

The table 5.2 shows that all the participants were aged from 20–40 and began their TTP in 2014, 2015, or 2016. All except one are language teachers, and the other participant teaches Mathematics and Physics. Additionally, these PSTs had no work experience related to the utility of digital technology, and all except one had no prior educational advantage of attending any ICT-based course. These facts show that all the respondents had primitive or limited ICT educational or professional backgrounds and were thus dependent on the TTP to gain the knowledge to operate and integrate digital tools in their classroom teaching.

5.4 Data Collection

The quality of qualitative research depends on rigor and thick data description. In this study, interviews were the primary source of collecting descriptive narrative material from the participants. Data from the interviews were produced by conversations between the participants and the interviewer. Their interaction potentially brings to surface many aspects of the participants' perspectives, which allow the researcher to later analyze based on these perspectives (Brinkmann & Kvale, 2015). Interviews are also guided conversation to obtain targeted information (Yin, 2009) and are "*pipelines for transmitting knowledge*" (Silverman, 1997, p. 113). The conversations occurred in the form of questions and answers between the interviewer and the respondents are here all considered as part of the data ready to be analyzed. Furthermore, Patton (2002) asserted that "*open-ended responses permit one to understand the world seen by the respondents*" (p. 21). Semi-structured interviews allow a flexible conversation for the researcher to understand the perspectives of the participants (Daymon & Holloway, 2005). In this study, the mode of data collection involved semi-structured interviews, where open-ended questions served to extract descriptions and perceptions of the PSTs' experiences regarding the PDC.

Additionally, semi-structured interviews were conducted to better understand the PSTs' perspectives and experiences developing their PDC. The flexible nature of the semi-structured format allowed the researcher to revise, refocus, or reinforce the questions that best facilitated the respondents' comprehension. In turn, the respondents were to respond by using certain Norwegian terms to express their perceptions and experiences. The interview guide was based on

the study designs acquired from the objectives of the CoE (as mentioned in Chapter 3) and aligned with the analytical framework selected to measure the PSTs' PDC development.

Furthermore, the semi-structured interview guide had a set of questions that were selected during the conversations to extract information that aligned with the research question. Beyond this, the researcher developed a checklist complementing the interview guide to record the areas that needed to be addressed during the interview. The interview guide and the checklist are available in the appendix. Next, the participants were emailed the consent form, which they signed before their interviews. The consent form informed the participants of the primary purpose of the study and that the data would be collected through audio recordings using the app Nettskjema Diktafon, which safeguards audio data in accordance with GDPR and NSD. Lastly, the interviews were audio-recorded with the consent of the participants.

5.5 Data Analysis

After the data were collected, they were transcribed using the tool Go Transcript. The data were analyzed using an approach known as "*meaning condensation,"* proposed by Brinkmann & Kvale, 2015), which is similar to Systematic Text Condensation (Malterud, 2012). This approach has been utilized for analyzing extensive interviews to categorize their meanings into main themes. At that point, the research goal was to analyze the main themes according to the study's theoretical framework, depicting the relationships between the variables and analyzing the experiences and perceptions of the PSTs in developing their PDC. In this study, the process of meaning condensation occurred in the five stages proposed by Brinkmann and Kvale (2015) and Malterud (2012), as follows:

1. Overview of the data

After transcribing the data set, the researcher became familiar with the individual participants' views on the study's main agenda by reading the entire dataset. This stage helped the researcher develop an overall understanding of the dataset.

2. Indicating "meaning units"

In the second stage, there was a systematic review of the data. The meaning units consisted of views of the participants that aligned with the research questions. This stage was crucial in

obtaining meaningful data; so, the researcher chose units with flexible, broad meanings. This flexibility in choosing codes yielded more meaningful units that directly provided rich details from the participants' limited data to enhance the research quality. Next, these meaning units were categorized and sorted into initial codes.

3. Thematizing the statements

The condensation of the meaning units began at this stage. At this point, the empirical data were reduced by selecting the meaning units and converting them into themes. The complex, broad dataset was then condensed into smaller and meaningful categories/themes that portray similar interpretations of the participants into categories or themes. Additionally, the participants' experiences and perceptions, which provided notes for analyzing the data, were precisely rewritten. These themes were formed and prioritized based on the main agenda of the research questions. Beyond this, some of the initial meaning units formed subunits that were later analyzed to form parts of the main themes.

4. Interrogating the meaning units

At this stage, the condensation of the data and themes was finally used to answer the research questions. At this stage, the researcher synthesized the results to achieve validity and wholeness for answering the research questions. This stage's focus was to evaluate the themes and connect them with the purpose of the study.

5. Writing the findings

The final stage involved writing a descriptive narrative of the findings in the third person, including quotations from the interview transcriptions. The findings chapter constituted analyzing and organizing the themes in a systematized manner. This stage prepared the dataset to be discussed in the findings chapter to answer the research questions. Lastly, the main findings were illustrated with quotations from the original dataset.

The focus of this thesis was to capture the various experiences of the participants in the final analysis of the data. Due to the inductive nature of the qualitative inquiry, the constructivist position of the study suggested that the meaning of these experiences could be extracted from

the data collected (Creswell, 2104 p.9). Finally, further critical discussion of the data will be presented in the last chapter.

5.6 Quality Criteria

There are diverse views on defining the quality criteria of case studies, especially qualitative case studies. The notions of reliability, replicability, and validity have been justified in the quantitative and realms of natural scientists, and academicians have been trying to translate these terms in the qualitative research. Similarly, generalizability has been extensively debated by academicians, with some holding the view that the findings from a case study cannot be generalized in the social sciences (Thomas, 2016). However, mainly generalization do not occur in the formal sense based on qualitative case studies, but the descriptive nature still adds value to a general debate or research by providing examples and paving a path for further investigation and innovation (Flyvbjerg, 2006). Furthermore, a popular stance on case study research suggests that the aim of a case study is to generalize on a conceptual on theoretical level rather than to empirical populations (Bryman, 2016; Yin, 2009).

Notions like reliability and validity tend to increase the quality, rigor, and potential of any research. However, "*the quality of the case study will be determined by the integrity and the coherence of this line of inquiry and the extent to which you can weave together data from a range of sources in addressing the narrative that you develop"* (Thomas, 2016, p. 111). In the same vein, Bryman linked the notion of reliability with the replicability and consistency of a study's findings (2016), and Kvale and Brinkman connected reliability with the consistency of respondent answers (2015). On the other hand, validity refers to the inferences drawn from findings related to theoretical assumptions and previous research (Bryman, 2016).

Furthermore, this case study provides *"rich, thick description to convey the findings"* to establish the study's validity (Creswell, 2014, p. 202). Additionally, the study follows the primary criterion of being trustworthy, proposed by Lincoln and Guba to establish the validity of a study (1986). The latter criteria are based on four distinctive segments.

1. Credibility

The credibility of the data can be achieved by ensuring the saturation of the data. The researcher conducted the pre-testing of the interview guide with peers. Additionally, a mock interview ensured the credibility of the interview guide and confirmed the data to ensure it answered the research questions. This process has been termed “peer debriefing,” as mentioned by Lincoln and Guba (1986), allowing a researcher to gain an objective opinion of a peer. Additionally, case studies should generalize theories that are credible cases. In this study, this analytical framework is used to explain the development of the PDC in a specific sample of students to understand the results and compare them with other similar studies.

2. Transferability

Transferability can be interpreted into external validity. In this qualitative research, the sample size was fewer than 10 participants. Thus, it would be difficult to transfer these findings to another context, even a similar one. However, validity can be maintained by providing a thick, rich description of the experiences of the participants to draw conclusive results from the data. Additionally, these data provide an in-depth discussion on various study designs and the perceptions of the PSTs, making sure that all the participants receive equal representation in the findings.

3. Dependability

Dependability is parallel to the concept of reliability. In this study, the former was achieved by explicitly defining the different phases of the study. These phases include the following: establishing the criteria for recruiting participants, searching and writing the literature review, explaining the terms used in the thesis, and understanding the context and unit of analysis for this study. Additionally, dependability was achieved by thoroughly documenting the process of conducting this study to secure reliable results.

4. Confirmability

Confirmability is parallel to objectivity. While conducting the interviews for this study, the researcher attempted to be objective and not give either preferential or prejudiced treatment to any of the study respondents. This attempt continued throughout the data collection, analysis and when recording the findings of the study. Beyond this, the researcher’s supervisor and peers

helped in translating the data analysis in the findings section, employing objectivity against any personal biases that could have changed the conclusion.

Reliability and validity tend to increase transparency and decrease research bias. To ensure the reliability of this research project, the researcher has attempted to be as transparent and explicit as possible in presenting the analysis and drawing conclusion.

5.7 Ethical Considerations

Researchers should maintain the integrity of their research by building trust with and protecting the privacy of study participants, following the laws and regulations on ethics of any applicable university or national research units (Israel & Hay, 2006). Prior to conducting the research for this study, the interview guide and the consent form for the participants were approved by the Norwegian Centre for Research Data (NSD). Furthermore, the study was grounded in the four basic principles proposed by Bryman (2016 p.125): harm to participants, lack of informed consent, invasion of privacy, and deception. These principles guided the researcher on how to interact with the participants and how the data should be collected and stored. In turn, the participants were informed about the purpose of the study, their contribution, and details about the data storage before signing the voluntary consent form to participate. In the same vein, the researcher ensured that the participants were comfortable with their surroundings while conducting the interviews. The privacy and anonymity of the participants were respected in accordance with the guidelines of GDPR. Additionally, the informants' participation was voluntary, and they could withdraw their consent at any point during the study. However, these volunteers comprised a self-selected sample, raising the chance that the results of this thesis might be biased. Lastly, the study gave the participants pseudonyms in the findings section to maintain their confidentiality. The study will comply to the guidelines from GDPR and NSD. Based on these methodological considerations, the next part of this thesis reveals the empirical context of this study.

CHAPTER 6: REPRESENTATION AND ANALYSIS OF THE FINDINGS

This chapter aims to present the data findings and analysis in relation to the study designs implemented by ProTed at the TTP at UiO. The respondents are PSTs enrolled at UiO, and all were either in their fourth or fifth years of the program or had recently finished TTP in 2020. Most of the respondents were language teachers, except for one respondent, a pre-service mathematics and physics teacher. This chapter employs the research questions to structure analysis, the structure that I found helpful to organize and present the findings in writing. The data have been analyzed using the Meaning Condensation method (Brinkmann & Kvale, 2015) and the Systematic Text Condensation method (Malterud, 2012) into the following six distinctive themes.

6.1 Pre-service teachers' Reflections on Theoretical and Practical Knowledge Regarding the Integration of Digital Tools

In this section we see PSTs perceptions regarding the attainment of their theoretical and practical knowledge by enrolling in their five-year TTP. First, the informants in this study claimed that they had learned many innovative digital tools like MINECRAFT and Prezi as learning and teaching tools in the classroom. Beyond this, several respondents also asserted that they had learned and observed the impact of digital tools during their internships, such as Mentimeter, Google Forums, and Google Schemes, as didactical tools for teaching and learning English and mathematics. However, the PSTs mentioned that their campus-based courses and seminars, especially PDCM, were quite theoretical in nature. *"We had a lot of theoretical approaches we learned about this (digital tools) and how they can help the learner and the teacher, but the practice part was not very prevalent."* (Alice). Thus, along with mentioning the quantity of the theoretical approaches, the PSTs urged for opportunities and time to practice these methods at the university campus. Moreover, the PSTs stated that the campus-based modules aiming to enhance digital competency were integrated into other pedagogical modules, as explained here:

> I would expect to have you know more guidelines to be given more specific tools to test these tools during the [on-campus] seminar … then you have two hours' that you're with everyone … with the people who do all the subjects, and the focus is more on the teaching methodology, pedagogical methodology and technology so it's very … very general. (Jenna)

With regards to the development of theoretical knowledge, Jenna, suggested that she was disappointed with the module and felt that she needed concrete guidance related to the use of technology in seminars. She also suggested that a list of technologies and tools to work with could be more beneficial. The question here is although if a list of tools would be a sufficiently well-grounded approach for competence development? Given the growing number and rapid evolvement of digital tools, this would soon be outdated and thereby not necessarily provide a good basis for the student to handle rapid upgrading and replacement of tools over time. The informants seem not to realize that they need a holistic knowledge basis related to digital tools as part of their professional competencies and practice development.

In addition to the general nature of the theoretical courses, Jenna also mentioned the limited practical implementation of the theoretical knowledge at the university. On the one hand, the PSTs accepted that they had learned theoretical knowledge about the use of digital tools, but on the other hand, their account of their experiences portrays their lack of acknowledgement about the importance of theoretical basis for integrating digital tools to teach. In this way, the general perceptions of the PSTs revealed therefore a perspective that to a lesser extent valued the importance of theoretical notions and what role theory plays in the more extensive development of their digital competency in teaching.

Practical knowledge of integrating digital tools starts with the PSTs participating in the PROMO program, with an emphasis on the University-School partnership that enables the students to practice a 100-day internship. The PSTs also clearly expressed their appreciation of the internships that provided them opportunities to learn and get acquainted with the relevant digital tools for teaching in a natural and realistic teaching environment. For instance, the participant Anna declared, *"I feel like when I've been on the internship has helped a lot more because then you can see actually, like, get a feel [for] how the students are responding in the classroom."* As explained by Anna, also another informant valued practicing real-life scenarios to familiarize themselves with how students in their classes responded to their pedagogical capacities. Additionally, the PSTs claimed that they tried to experiment with digital tools to engage students in their classrooms, stating that integrating the technology depended on their learning outcomes and contributed to develop their pedagogical plans.

Another aspect related to the practical knowledge is revealed when the PSTs asserted that the internships enabled them to learn and practice the pertinent digital tools in their schools under the supervision of their mentors. The PSTs are assisted during their internship as Jess mentioned,

> I have been a part of the mentor program all semester, and I think it's [an] excellent way to do that [the integration of digital tools] because then you get experience of how teachers use digital tools and what they recommend—or maybe what they do not recommend—and what works in the classroom. (Jess)

As praised by Jess, the mentoring program is perceived as a guiding and assistive learning designs that bonds the PSTs with the learning environments at school. During their internships, the PSTs were assigned mentors to guide them. These mentors demonstrated how they integrated digital tools in the classroom. The PSTs observed their mentors during their internships and practiced integrating a variety of digital tools in their teaching, including the use of LMS such as "Its Learning," "Showbie," and "OneNote" to evaluate each student's progress. Additionally, the PSTs claimed that they integrated Google Docs, Google Forum, Mentimeter, and Kahoot to teach, assess, supervise, and give feedback to their students. This depicts that the PSTs have been able to reflect on the variety of digital tools that they integrated and experimented with to gain a variety of pedagogical aims that are part of their teaching profession.

With regards to theoretical and practical knowledge about the use of digital tools, PSTs claimed that they are confident in integrating digital tools and further claimed that their theoretical and practical knowledge of digital tools had also been part of their own student lives. However, their statements seem contradicting and the data from the above analysis suggested that PSTs to a lesser extent realize and make use of their theoretical campus-based courses in relation to their practice with the digital tools available in school during their internships. With an aim to bridge the gap between theory and practice, the Oslo Model represents the overlap and continuous shift of the PSTs' university-based courses and their internships, starting from their third semester. The findings do although show that the PSTs explained and understood that digital tools are becoming part of their learning environments. That is, they therefore have paved the ground by adapting to the integration of digital tools for teaching, learning, supervision, and assessment in their learning environments, but to a lesser extent they related this to a more overarching conceptual notions and reflections.

In this section, the practical and theoretical dimensions of this study are discussed simultaneously to explain the perspectives and experiences of PSTs during their formal education. The PSTs mentioned that they had acquired theoretical knowledge about the use of digital tools during their five campus-based years. Later, during their 100-day internships, the PSTs describes their practice where they could experiment and expand their knowledge of digital tools. The theoretical and the practical dimensions contributes to the development of the PDC among the PSTs. These areas are conceptualized as self- or the mental awareness, demonstrated in the practical proficiency represented on the vertical and horizontal axes of the Teacher's Digital Competence Model (Krumsvik, 2014). The horizontal and vertical axes of the model represent the adaptation, adoption, appropriation, and innovation to explain and analyze the development of the PSTs' PDC. Additionally, these practical and theoretical dimensions cover basic skills needed by PSTs, such as ICT-didactics, learning strategies, and the attainment of digital *Bildung*. The data showed that PSTs attained the theoretical knowledge during their formal university courses but showed a limited reflection on connecting it with their practice during their internships. Regarding their practical proficiency, PSTs mentioned that their campus does not offer any practice with the use of digital tools and that the PSTs mentioned that they were guided by their mentors during their internships. Thus, at this level, these PSTs were in the process of learning contemporary digital tools, and their experiences and perceptions revealed that they are adapting the digital tools without fully recognizing their theoretical basis and impact on students in their tearning environments.

6.2 Notions of Role Modelling

Role modelling requires the teachers to show their competency and exhibiting aspects of their digital identities by demonstration the use of digital tools in their classrooms. Thus, this process illustrates the notion of "digital *Bildung*," which according to Krumsvik (2012) displays the highest level of PDC among teachers and portrays a metaperspective in exhibiting the digital competency by showing through practice. Role Modelling also relates to exposing both positive and negative issues related to the use of digital tools in the classroom for students. The section explores the perceptions about the role of teachers and role modelling in digital learning environments.

With regards to role modelling, the PSTs claimed that their professors and mentors served as models for the PSTs regarding the use of various digital tools in the classroom. However, when discussing their campus-based courses, the PSTs criticized a lack of modeling by their professors in

reference to the use of didactical ICT tools during their elective subjects. For instance, Jess made the following statement:

> When we go to university, most of our teachers use PowerPoint, and that's the far[thest] they would go. If a professor use[s] something other than … PowerPoint, then we are surprised. I would say that if our teacher at university use[d] more … tr[ied] more different tools, I think that would inspire the students to also.

This statement reflects the appreciation the PSTs have for the practical demonstration of integrating digital tools rather than theoretical contemplation. Additionally, the PSTs mentioned that the professors stuck to Microsoft Office, which has also become the most common tool used by the PSTs. However, although Office has been the preferred tool of professors and PSTs during their university years, the PSTs suggested that they expected their professors and mentors to integrate advance digital tools into their classes. As discussed earlier that the integration of digital tools depends on the pedagogical aims, thus it would be quite unrealistic to argue that their professors must or required to integrate advance digital tools for their classes at the higher education level.

Most of the participants that were language teachers, relied more on the writing and reading digital tools, such as Microsoft Office, Google Docs, and social media platforms, tools that were modeled by their professors. For instance, Anna, the mathematics PST, mentioned that she incorporated mathematical tools such as MATLAB and Python that her professors used in their subject-specific programs to teach mathematics. She mentioned that the professors modelled digital tools that were more complex than the one she would incorporate later to teach mathematics during her internship. While Anna claimed to integrate mathematics digital tools at her internship showed the PSTs are most likely to choose subject-specific tools that are part of their learning environments at university. There is also a concern about the level of education (secondary versus higher) and the digital tools that support the learning at school might be different than the university. The PSTs need to be aware of what they can integrate that supplement their teaching outcomes.

Another aspect related to the notion of role modelling is seen during their internships when several respondents mentioned that they were able to observe how their mentors integrated digital tools into teaching, classroom management, and assessment. For instance, Jenna

mentioned that her mentor gave her a thorough tour of the school digital learning platforms (Its Learning), saying these are the important digital tools for teachers to know. Elsewhere, Rina stated a similar experience, where her mentor showed her a *"digital book that the students had online and how to use it, like with they* [students] *could play the audios and it would make it easier for them to be prepared for the lessons."* This portrays that the mentor program acquaints the PSTs with the infrastructure and routines that they will need to adopt later in their careers. As part of the mentor program, the TTP ensures an assistive practice of teaching with the prevalent digital tools at internship. The PSTs mentioned that they were able to observe their mentors and learn about their new digital learning environment.

Regarding modeling, the PSTs stated that as teachers during their internship, teachers are able to demonstrate what is relevant and important for the students. One of the respondents, Alice, asserted that the position of *"teacher is like a leader I think in the classroom, where the students are using digital technology."* Thus, a teacher's role should *be "to model, like show how to … how to do it and how you can do it well"* (Alice). While the PSTs claimed that the positions of teachers in classrooms makes them role model or leaders for their students, however, at this stage the PSTs are still learners themselves, could they see themselves as role models? Do the PSTs acknowledge the risks of being a bad role model or the importance of being a good role model? At this stage the claims or aspirations to act as role models are positive while the enactment could have negative consequences as the PSTs are still learning to become teachers.

Furthermore, the PSTs stated their perceptions about modelling the integration of digital tools during internship that enables the teacher to both deliver content knowledge and impact the development of digital competence among their students. Beyond this, the PSTs mentioned that their responsibilities extended further as role models to implement a high level of ethics and safety protocols related to digital tools. In the same vein, Rina explained that it is a teacher's responsibility to demonstrate "*how to be safe online*" to their students. She further commented that this issue is a significant part of integrating digital tools. That is*, "children are not ready for or [do not] think about [digital tools]. The biggest … danger with being online is that it looks like reality but it's not reality".* Employing this viewpoint, these PSTs are able to reflect upon the competency the teachers ought to have to guide their students in understanding the ethical and moral issues.

The notion of role modeling has been generating positive discourse among the PSTs where they aspire to become good role models for their students. In the light of their perceptions, the PSTs are seen to be finding their place in their teaching environments. Role modelling is seen as the highest point of Teacher's Digital Competency Model known as digital *Bildung* which requires the teachers to understand their responsibility as teachers. The *Bildung* level expects the teachers to exbibit a higher quality of competency and their identity as teachers. This stage extends beyond the competency of integrating digital tools and also portrays the underlying cultural and social responsibilities as teachers. The data reveals that the PSTs are observing their professors and mentors and stated a very positive attitude towards teaching being role models for their students.

6.3 Reflection on the Development of Digital Competency for Subject Didactics

It is crucial for PSTs to understand the digital tools specific to their subjects. In this study, the PSTs mentioned that their primary source of didactical knowledge came from their university professors, who provided them with theoretical knowledge about the didactical use of digital tools. The respondents mentioned a module that was taught by subject specialists, who introduced the digital tools, pedagogical theories, and strategies specific to their main subject areas. According to Krumsvik (2012), "ICT Didactics" is related to the competency of teachers in which they are able to integrate digital tools that align their pedagogical and content aims. During their campus-based courses, the PSTs mentioned that their didactic courses were quite theoretical. As mentioned in ProTed Annual reports, the didactical courses are formulated with the collaboration between the faculties and the teacher education department. The PSTs mentioned that they participated in formal lectures and seminars on the didactical ICT tools for teachers. Alice mentioned her experience as follows:

> The only part we had in PPU [TTP] was that you know it's like a thematic area … of the specific subject. For me, it was English and … pedagogical seminars … that is very theoretical, and they explain … how to use technology in the classroom, but it's more based on class levels—you know, how to be a good teacher. (Alice)

This statement depicted that these courses introduce the variety of digital tools that the PSTs are required to know for their teaching. This statement also reveals that these tools are also according to the grades the PSTs are ought to teach. The course as cited explains theoretical approaches on how teachers integrated digital tools for their subjects, meaning English in this case. As mainly

language teachers, the PSTs mentioned that their focus was on the reading and writing tools connected to teaching and learning languages.

The practice part of the integration of digital didactical tools starts during their internship. Jess mentioned that she incorporated OneNote as the didactical tool for the student to write. She further mentioned that this tools also helped her to assess the students in class while they were writing on their iPads. In this case, digital tools were used to achieve two pedagogical aims: developing writing skills and class management or supervision. These notions fall under the category of "ICT Didactics and Learning Strategies", referring back to the Krumsvik's statement:

> TEs (Teacher Educators) must utilize student teachers' basic digital skills and maintain a strong focus on the metacognitive aspect to learn and practice their knowledge of digital tools. The latter enables student teachers to delve deeper into the pedagogical use of ICT as an entry point for developing new learning strategies (Krumsvik, 2014, p. 277).

It focuses on the importance to link the integration of digital tools for teaching specific content with a clear pedagogical aim such as metacognition or raising critical awareness among the students. Similar to the use of OneNote, PSTs' interviews revealed that they also integrated Google Docs to attain a similar purpose as mentioned earlier. Furthermore, apart from these writing tools PST, Rina integrated the language application Duolingo, stating following reflections:

> [Duolingo is] a great tool, especially for students who need a little bit less discipline. They need a little bit more time to work in their own world[s] with something they find fun, and Duolingo is kind [of] like a game. So, it opens [students] up [to] learning about English but in [a] more subtle way and [a] more fun way.

As we see from this quotation, Rita sees the integration of this not only as a didactical resource to learn and revise language but also served the purpose of engage students with less discipline and motivation. Like Rina other PSTs mentioned that digital tools like Duolingo and Kahoot challenge the students with digital quizzes that assess their knowledge of a subject and allowing teachers to track their progress. Furthermore, the PSTs mentioned that they made videos as a teaching recourse for topics requiring repetition, especially grammar, and posted the videos on Its learning claimed that it enhances and reinforce students' learning.

Similarly, the mathematics PST, Anna, mentioned that she incorporated mathematical tools such as MATLAB, Python, and Google Forum to teach mathematics. Referring to Google Schemes she mentioned that

> Last week, we designed something on … Google Schemes, like … a sign-up Google… Google Forms, where you have to … solve tasks in order to get to the next page, and then … it was a surprise at the end … it's not like the task that you could see in your textbook. [Instead,] it's [that] we got … the opportunity to be a lot more flexible, and it's awesome that provided a lot more opportunities as digital tools.

This quotation illustrates how several of the informants express why and how they are integrating didactical tools. Here, Anna described how the digital tools in here case was experiences as a valuable alternative and extension to physical book, which in here opinion positively impacted on the student's classroom engagement and learning. Similarly, another PST, Rosy introduced Mentimeter which she explained creatively engage students in learning through discussing and conveying knowledge using digital tools in the classroom. Thus, PSTs claimed that they are learning the integration of digital tools specific to their subject areas and observing the impact each tool has on their students' learning, scaffolding, metacognition, engagement, and learning outcomes.

The above discussion about the development of didactical digital competency suggests that PSTs are adapting the subject specific digital tools that are prevalent at their educational institutions, both at the university and schools. During the interviews, the informants reflected on their self-awareness in determining the digital tools for teaching specific theme revealing that they claimed to understand the dynamics around digital tools where the technology becomes secondary, and the focus is on the content. This has also been discussed by Krumsvik that PDC requires the teachers to recognize and have authority of content and form in a way that digital tools become transparent, and the content becomes visible (Krumsvik, 2014). The PSTs have started to understand the epistemic implications of integrating digital tools by focusing on the epistemological part of digital tools in their teaching and learning environments.

6.4 Reflection on PSTs' Digital Motivation and Pedagogical Judgment

PSTs claimed to have a positive attitude with the inclusion of digital tools in their teaching and learning environments. The informants claimed to be actively engaged in their digital society which impacts their digital competency. For instance, Jess made the following comment:

> I think a lot of it [digital competence] came from just living in a digital world outside of the university, but some parts of it, like learning how to give feedback on its learning [LMS] that came from the Lektor Program [TTP] but mostly despite existing in the world of technology.

The excerpt above is illustrative of how the informants assert that their digital competency is influenced by their informal interests and their heavy reliance on digital technology. The same respondent, Jess, revealed her interest in computers and PlayStation, and like others, PSTs claimed that their digital skills outside of their professional zones positively impact their digital competency in the classroom. Krumsvik suggests that the teachers and students in Norwegian digitalized society are engaged with digital media and tools, but these competencies only impact their basic digital competency. The reason for this is that teacher educator's digital competency is distinctive to their profession because as teachers their PDC requires them to integrate didactical, pedagogical tools and uphold digital *Bildung* (Krumsvik, 2014). Additionally, it is also important to state that PDC is also not confined to learning the LMS or providing feedback for students, as Jess mentioned, instead, these skills are related to understanding how and where digital tools are integrated, the pedagogical aims these tools achieve, and how teachers master these tools in their classrooms.

Another aspect relating to the pedagogical judgement about the role of teachers in the classroom is that several respondents mentioned that the role of teachers should be active even with the integration of student-centered digital tools in classrooms. PSTs further asserted that the teachers must also be independent in determining which digital tools to use and when/how to integrate these tools. However, Jenna claimed that the role of the teacher stays relevant with or without the use of digital tools. She explained,

> I would say that the role of the teacher is still to teach, and the tools become supplementary, so they are not the main teaching tools, but they can be used as support wheels and help the teacher get across [concepts] they wanted to teach or learn.

As cited, PST Jenna expressed that she regards the role of the teacher as crucial and agreed that digital tools are integrated to achieve pedagogical aims. Jenna made similar remarks by stating that *"I think for me the most important [thing is] that students learn what they should learn and then I find it important that digital tools are [supportive] tools and not an aim in itself".* It explained that their pedagogical aims should guide their choice of digital tools and not the other way around. As mentioned before, these perspectives presented by the informants align with Krumsvik's emphasis on the epistemology as the guiding force and the technological tools being the support for the attainment of pedagogical outcomes (Krumsvik 2008). Additionally, they mentioned that during their lesson planning, they always think about what digital tools they can integrate during their teaching and how these tools could help them to achieve their goals. In this way, the PSTs expressed perspectives in line with competence in using digital tools as well as pointing at deeper, more fundamental purposes behind integrating digital tools into teaching and learning.

Another interesting aspect surfacing in the analysis with relevance to the PSTs digital motivation, are several descriptions of being quick and eager learners when navigating digital tools and their supposed willingness to discover digital solutions. Additionally, the PSTs stated that they faced many *"trial and errors"* during their internships with relevant school-based digital tools, which they claimed took them a day or two to master (Rena). This illustrates that the difference between their everyday digital proficiencies and the development of their profession-specific competence. They also mentioned that they relied on their mentors, their peers, and Google for digital support and to expand their digital tool vocabularies. For instance, Rina mentioned that *"Google is your best friend as a teacher."* Notably, most PSTs turn to Google as their first choice to search for digital tools and digital solutions for their teaching and learning environments. Beyond this, although these PSTs may be motivated to integrate digital tools, they are still navigating the tools they can use in their classrooms. This situation relates to the PSTs' earlier comments regarding more theoretically formatted campus-based courses, which the PSTs failed to mention as a form of assistance during their internships. Similarly, this information suggests that the PSTs who claimed to be competent with digital tools were still quite lost with the practical integration of these tools during their internships. On one hand PSTs criticized the theoretical nature of campus-based course but on the other hand struggle to make connection and expand on their theoretical knowledge, thus, contradicting their statements. The PSTs underestimate the importance of theoretical concepts that are important to grasp in order to reflect on their practical abilities.

The PSTs reflected that during their internship they claimed to be motivated in experimenting with various digital tools. Illustrative to these experiences is Rosy's experiment introducing digital tools during her internship:

> They [mentors] didn't really kind of want me to use other different kind[s] of digital tools like that; they didn't really care because they didn't really use any digital tools. They just had a PowerPoint and maybe [a] YouTube video but nothing else really, so they were kind of surprised and were like, "Wow! That was a cool way to teach."

This rather critical statement suggests that PST's not always experience that their mentors emphasized the use of digital technology during their internships. The statement is on the other hand also nuanced as mentors also show interest in situations where the PSTs' demonstrated novel use of digital technology in the classroom. Additionally, informants also mentioned that the classroom generally had a digital setup for the teachers and students to use. In this sense, the data demonstrate some of the complexities PSTs are facing during internship when encountering mentors with different digital backgrounds and interests as well as the schools with varying traditions and conditions concerning the use of digital technologies.

Another motivational feature to be mentioned is that all the respondents agreed that digital competence is essential for teachers in their classrooms. The PSTs stated that they were aware of their responsibilities to both master the digital tools available at their schools and introduce the most advanced, innovative digital tools to their students. On this topic, Jenna asserted that teachers should be digitally competent enough to integrate digital tools and engage students in the learning process:

> I think that we live in a world where there is a lot of technology, and [this technology] has become necessary in order to teach, I would say. I have seen in my teaching practice that those teachers [who] don't use digital tools … often struggle to teach, and they don't get their students involved as much as when they teach with digital tools.

The above utterance underscores a motivation for using and being capable of handling digital technologies as teachers and that digital tools are emphasized as vital in the profession and that without these tools, teachers would be restricted and fail to elicit student engagement. This although contrasts with previous considerations from the same informants that digital tools are

"supplementary" to teaching and that digital tools play supportive role in the classroom, but still only are tools. In this sense the above statement to some extent illustrates that the issue of digitation is complex, and that the PST's themselves not always are see all nuances that are in play with different school-settings, disciplines, available resources and more.

Perspectives on motivation also surfaces in the informants' experiences of technology use during the COVID-19 pandemic, a practice seen as good opportunity to facilitate uninterrupted education. Additionally, the PST Anna mentioned that during the pandemic, advantages with digital tools' have been further strengthened in the education sector. She explained, *"I mean, even after Corona, you can see the clear effects of how digital this world is, how actually we can be very effective … if we use the [available] technology."* Anna further mentioned that the teachers were connecting to their students via Teams, OneNote, and Its Learning. These practices demonstrate that the PSTs were able to adapt to using new technologies for teaching in a time of crisis, a relevance they seem to consider as encouraging. Beyond this, the PSTs asserted that the Norwegian education system has been emphasizing digital skills for students from grade 1 with iPads or laptops as personal digital learning devices for basic learning, which are now part of their everyday school lives. As a general pedagogical judgement, the PSTs consider these personal devices as an important premise for enacting digital teaching.

Another notion of pedagogical judgement with regards to the recognizing their digital competency as teachers revealed that several respondents claimed to have adequate levels of digital competency, while some desired more techniques and opportunities to practice digital integration further. In this regard, Rosy explained that

> I would say my competence is OK … it is how it's expected for me like being a new teacher in these days being in a new modern classroom. I feel like I'm kind of there, but at the same time, I feel like I should have learned … other ways to expand my digital vocabulary.

This comment, which is not unique in the material, illustrates that although the PSTs felt they on one hand acquired sufficient knowledge of digital tools, on the other hand also see a potential for further developing their conceptual and theoretical competencies. In teacher education this 'vocabulary' is generally addressed in teaching with the purpose of establishing a theoretical basis for professional discourse and reflection. At this point the informants although do not directly

make this connection between personal perceptions of learning to become teachers with their theoretical course content at the university that concerns with the use of digital tools in school-based education. Yet again, we see the indications that making such connections are challenging for the PSTs and difficult to achieve for teachers at the TTP during formal training.

Another aspect related to the discussion above is seen from further data analysis is that the PSTs are not only challenged to implement their theoretical knowledge into their practical domains, but they also tend to rely on their own judgement. In this regard Anna states that, *"I feel like it's up to us to use our sense of judgment … like our perceptions and … mak[ing] use of our judgment".* This confirmed the tendency that the informants often relied on their own sense of judgment to deal with issues, such as ethical concerns related to safety, consent, and privacy of the students. Rather than referring to conceptual based discussions or systematic studies which are part of campus-based courses, they seen to draw their own personal judgment, which at this stage of their education lacks a more grounded and systematic approach. In this vein, Alice shared an experience dealing with the distribution of nude pictures during her internship, where she was guided by the school to address the issue. She was responsible for contacting the police and informing the students about issues related to child pornography. This example illustrates the necessity for teachers to handle technology professionally in a range of settings and situations and that personal opinions and perspectives need to be extended in correspondingly recognizing the ethics and societal rules connected to the integration of digital tools in their classrooms. These issues are related to the development of teacher's digital identity, which Krumsvik called "digital *Bildung*" (Krumsvik, 2008). The data seem here to suggest that the informants may still have some way to go in conceptualizing such issues, while having little or no problems in handling digital tools on a technical level.

6.5 Pre-service Teachers' Perceptions about Learning Management Systems

The use and integration of Learning Management Systems (LMS) is an important part of daily classroom both at campus and in schools used by teacher and student. In this sense, the informants called LMS as their "go-to tool." An interesting observation form the interviews is that the informants during their campus-based years, considered digital platforms as strongly user driven that aimed to serve manifold purposes. Rina mentioned that *"some university teachers and professors … make Canvas look very like nice and easy to like navigate, but with some [professors], it's just that it's a big mess".* The PSTs' experiences with the use of Canvas revealed that they had become more conscious of navigating and organizing the learning resources on the LMS. Thus,

these experiences are crucial to understanding what works and what doesn't in the use of these digital tools.

Apart from the transition from Fronter to Canvas, many PSTs recalled that they took one of the PDCMs online, where the LMS was used to provide the PSTs with the online resources for the module. In that, the PSTs were required to take the quiz at the end to pass the module. Rosy shared her experience of the module in stating that, *"Maybe it's my fault, but it was just there on 'Canvas,' like they said we had … to go through it just to get it approved, but I didn't learn anything from it, and for me it felt useless".* This citation describes the experience of most of the informants regarding the online module. The module was a part of their PDCM that aimed to enhance their PDC by giving them the experience of SPOC. The PSTs stated that their experience with the online module made them realize of the importance of blended learning. They further stated that they would prefer a physical class, seminar, or discussion sessions that can supplement the online module.

With regards to the integration of LMS, some PSTs shared positive experiences in other subject courses at the university. Alice mentioned that her Norwegian grammar teacher posted audio and video recordings that helped the students to repeat and reinforce their language vocabulary and pronunciation. On this subject, Alice stated, *"I had these videos for this Norwegian grammar course. They were very helpful in the sense that I'm not losing track, and I think it's a nice way also to incorporate it in the classroom if you teach language".* As stated by several respondents, one of the advantages LMS provides for students is to track and save all the educational resources they require for their exams. The PSTs were able to use LMS as students and later as teachers during their internships. Beyond this, the PSTs stated that they learned to integrate LMS such as It's Learning and Showbie during their internships. Rosy mentioned that Its Learning was prevalent when she was a student in school and that the LMSs used in schools now are multi-functional, as explained below:

> I saw that It's Learning had evolved a lot since I went to school, and I saw you could have this discussion forum, where they can discuss and ask questions, and you can have tests there, and you could share PowerPoint video links … I also like guides you to different kinds of games and quizzes for typical … different topics, which I think is good. Like, everything is on one platform— guide do you [in] different directions … to improve your teaching.

This participant mentioned that LMSs have evolved over time, now offering more than a digital platform for educational resources and a communication portal. The informants are in the case of LMS-use reflecting on the variety of functions that can be made part of their teaching, thereby also relating their digital knowledge of ways they can use it in teaching. This indicates on the one hand they realize that digital tools in the education sectors are continuously evolving, and that teachers are required to not only learn how to use these tools but also guide students.

Another PST, Anna elaborates the use of Its Learning during her internship. She states that

> [This platform is] a way of communication, and then since all the documents were also on Its Learning, then I was also … able to assess the assignments and their answers to questions and so forth. The students actually can get all their assignments there, what they will be taught next time, so they can have … a history of their assignments. They can go back [to] work on their documents from home. (Alice)

Several informants in similar ways explain how functions provided by the LMS are helpful for both teachers and students. PSTs' explanations illustrate here that they are recognizing and adapting the functionalities of the LMS as teachers; even though some of the PSTs expressed a more limited use of LMS in their classrooms. It was also interesting to encounter the discussion around making teaching resources and posting them on LMS to introduce their students to new topics on Its Learning with the purpose that the students would come to class prepared. On this subject, Rina describes the way she introduced a topic on Its Learning saying that *"I just think that [the] classroom would be more productive in terms of the students' [coming] prepared to … class … [to already] have some prior knowledge [when they arrive]."* This reveals the use of LMS for the pedagogical aim to engage students and developing their prior knowledge with the introduction of new topics. The PSTs had experienced a similar ritual in university, where some professors posted educational resources at the beginning of each module. Beyond this, the respondents commented that they preferred it when educational resources on the LMS were followed by a class in a physical classroom, where the same topic was discussed for reinforcement. These experiences provided the PSTs with ways in which LMS can support blended teaching and learning environments.

Another notion related to the use of LMS is the experience of 'flipped classroom' or 'flipped learning' where the teacher is able to assist the student in virtual and physical learning environments by posting learning resources on LMS. This enables the student to use their basic knowledge of digital tools to access the learning material online and develop their digital competency to further explore new learning strategies. While the PSTs mentioned that they preferred the concept of blended learning, they were also able to comment on the affordances of LMS. Although the PSTs had been able to adapt to the new LMS at university and schools during their internships, they were still learning and experimenting with ways to integrate LMS into teaching, increase student engagement, provide feedback, and facilitate communications with students and parents. Summarized, most of the informants express that they are able to adopt and adapt LMS in their teaching and learning environments, while some even surpass the adaption level by using this in more advanced. This was achieved by designing and composing teaching recourses that are later posted on LMS to prepare the student in advance. The appropriation level is also achieved by recognizing that the students need a discussion session or physical class that supplements the online information. The findings above thereby reflect not only the centrality of LMS as established digital portals, but also how students transcend basic functionality to achieve and further develop their pedagogical goals.

6.6 Experience with Various Assessment Forms and Tools

The teacher training program provides both summative and formative assessment methods integrating digital tools. In this section we examine how the informants describe their experiences with various digital tools for assessment during their formal teacher training; with emphasis on digital exams and video-based assessment.

First, the video-based assessment requires the PSTs to make a video of their teaching practices during their internships and bring the video to their university, where the professors and mentors and their peers provide constructive feedback. These experiences with video-based assessment varied widely among the PSTs. PSTs mentioned that they experienced the assessment format helpful, as it provided an opportunity for them to reflect on their teaching practices. For instance, Anna mentioned that *"it's a good way to learn how you teach maybe things you're not aware of while you are in the classroom, and you can see that on the video."* Similarly, Rina stated that *"it was definitely a learning experience, and I think I gained a lot of insight into how I actually present myself when a classroom—that was great, actually".* While these statements underline the positive outputs of this assessment training, it also contradicts the notions among the PSTs that

there have been a lack of evaluation and feedback or assistance in translating theoretical knowledge from their courses into their practical work with digital tools. So again, we see (as in previous parts of this analysis), that the informants have been assessed on their practical work and their ability in connecting the theoretical aspects to their teaching practices and digital technologies. This again underlines some of the complexities in making more abstract judgements of practical work in developing competencies as a professional teacher.

With regards to the experiences among the PSTs, it was also noted that everyone had different experiences with the video-based assessment. For instance, Rosy stated that at first, she was quite shy in recording and presenting the video in front of the class for discussion. However, she later confirmed that *"I can see the perks of filming ourselves and showing other students, so we can learn from each other".* In a similar vein, another respondent, Jenna, appraised it as a *"classical move"* to film one's teaching and review the footage later. She stated:

> I mean, actors … practice in front of a mirror, right? That's a classical move there; I think that's very useful. You can notice things that you would otherwise not notice, like, for example, that you talk to the students and write on the blackboard.

This video-based assessment provided opportunities for the PSTs to observe and reflect on their teaching practices and learn from the videos of their peers. It also became the medium to connect professors, mentors, and students in a single design where all collaborated on their development as teachers. In this way, the PSTs mentioned that they were able to discuss these recordings to learn how they could improve their teaching practices.

Second, digital exams are a compulsory part of five-year TTP and serve as a form of summative assessment. During each digital exam, the PSTs are required to analyze video based on real-life scenarios of common classroom situations. Next, the PSTs mentioned that they were required to implement educational theories, their subject content knowledge, and practical experiences to interpret and comment on the videos. The respondents stated that digital exams were flexible, as the PSTs could go back and forth during their digital exams and see each video many times before analyzing it. The PSTs expressed to their surprise that this online exam format falls under the category of digital exams. The PSTs did not call these exams innovative, and one respondent stated that she did not even find the experience to be especially "digital" because it felt normal for them to take an exam on the computer and upload the exam to Inspera. For instance, Rina

explained that the reason she did not find the digital exams to *be "digital" was "[be]cause I see how much we are using digital tools without even thinking about them."* Digital exams are more than just typing on a keyboard instead of using a pen and paper. Thus, it is important to see how students' experience these exams and what challenges could arise from this form of assessment. But what is interesting from the above statements is how natural and integrated these assessment settings merged also with other formats. In this sense, the assessment practice here described serves as a good example of how digital tools blend into the teaching and learning context, serving as tools to support other pedagogical goals. Even though the informants did not make these connections explicitly, it still coincides with what the informants have expressed previously with purposes of using digital tools for teaching and learning purposes.

It is although important to note that the digital exam in this study was very stressful for some of the PSTs. They mentioned that if a student gets stuck on a question, he or she cannot ask questions during the exam. Additionally, one of the respondents encountered some technical issues with the digital exam; she could only play the video once, so she felt that this was not an ideal exam form. Notably, assessment and feedback are a significant part of the teaching profession. In this sense, the PSTs were able to gain experience with both summative and formative assessment forms by using digital tools. To some extent, the PSTs also experienced opportunities to deeply reflect on advantages and disadvantages with video-based assessment, but it is also interesting to note that their conceptual discourse around these issues were less apparent during the interviews.

With regards to practicing assessment formats as teachers and giving feedback during their internships, the PSTs mentioned that they were able to incorporate various digital tools for assessment and feedback. For instance, some PSTs mentioned Kahoot as a tool used especially by language teachers to assess students as they practice spelling words, identifying word families, and assessing grammar. This experience was described as follows:

> I incorporated Kahoot exactly in order to do some quizzes at the end of a thematic area, for example. I was teaching grammar then [, so] it was easy for me to … make a quiz [, and] then the students were able to see some words … to question and to find out which is the correct answer. (Alice)

The integration of Kahoot reflected that the PSTs experiences other similar opportunities to integrate digital tools for assessment that are user friendly and exciting for the students. In this way, the PSTs mentioned that Kahoot and Duolingo is student-centered digital assessment tools that enable the students to not only evaluate their learning but reinforce and correct some of their misunderstandings during classroom. On this subject, the PSTs mentioned that they also incorporated digital tools such as Google Forums, OneNote, LMS and Google Docs to supervise, assist, and provide feedback to their students. The PSTs mentioned that these tools enabled them to supervise the students during their assignment and helped them to follow students' progress. These tools as mentioned by the PSTs enable the teachers to supervise the students remotely so that the students are not distracted by their personal digital devices in classrooms. These reflections portrays that the PSTs are learning to become more aware of the wider pedagogical aims in preferring the digital tools in their classrooms.

There is no doubt that assessment and feedback are key elements in the teaching profession. The data shows that the informants are able to reflect on their experiences with the video-based assessment and digital exams. The PSTs have been adapting the assessments formats and digital assessment tools during their teaching and learning environments. Beyond this, they were able to reflect on their deeper understanding of why they had selected assessment tools for example Kahoot or Duolingo during their internship, which shows that the PSTs are becoming aware and practicing the appropriation level of integrating learning strategies. As the PSTs mentioned that they were able to design quizzes with an aim to reinforce the thematic area and selecting exciting assessment tools to engage the students, portraying a higher level of awareness and practical proficiency in integrating digital tools as learning strategy. Moreover, the appropriation level is also seen when the PSTs are able to reflect on their choices of integrating digital tools such as Google Docs or OneNote that enable them to supervise the students and give feedback remotely. This point to deeper understandings of the pedagogical aims behind integration of assessment tools and also relates to some of the challenges the teacher might face in supervising the students with personal devices.

Summary

In the above analysis, several descriptions of the PST's experiences reveal that they have been a part of numerous learning designs that are targeting towards the PDC of the PSTs. They claimed to gain theoretical knowledge from their campus-based courses connected to pedagogy and subject-

didactics. During the internships, the PSTs mentioned that they learn about the practical integration of the pertinent digital tools in the classroom. One of the significant findings from the analysis of the data points to the gap between the theoretical knowledge acquired by the PSTs and the practical implementation during their internship. The data shows that the PSTs are unable to connect, implement or reflect on their theoretical knowledge during their practice in schools. They are adapting to the digital tools without recognizing the theoretical concepts and solely rely on their personal perceptions when reflecting the reasons for integrating specific tools.

Another significant finding is their strong perceptions relating to the role of teachers in digital learning environments. The PSTs agreed that the teachers must integrate digital tools according to the needs of their pedagogical plan. They were not able to directly state the epistemological significance in determining the digital tools, but they argued that the digital tools must align with the pedagogical aims and not the other way around. The data shows that the PSTs have been able to adapt the digital tools that are part of their teaching and learning environments. Moreover, the PSTs claimed to be confident and self-motivated in using digital tools, and their experiences in university and internships provided them with knowledge about digital tools specific to their profession. Being a PST, their experiences are limited but as digital native they claimed to be quick in learning and expanding their knowledge about the use of digital tools in their teaching and learning environments.

CHAPTER 7: DISCUSSION, CONCLUSION, LIMITATIONS, AND RECOMMENDATIONS

7.1: Discussions

The aim of the study was to scrutinize the experiences of a group of PSTs in Norway to investigate how the learning designs formulated by ProTed impacted their development of PDC. To address this broad theme, the study focused on a TTP affiliated with CoE-E called ProTed at UiO. The study was guided by the Teacher's Digital Framework developed by Krumsvik (2011) to explain the development of the PSTs. Therefore, this chapter provides a summarized version of the findings and structured on the following research questions.

Q1: What are the experiences of pre-service teachers during their formal teacher training program that are part of ProTed's goals for enhancing professional digital competency?

Q2: To what extend do the pre-service teachers of the current study experience that the formal teacher training program contributes to their development of professional digital teacher Competency?

7.1.1 ProTed´s Goal and Experiences of Pre-service Teachers

The focus of this study concerned the development of PDC among a group of PTSs who are enrolled at UiO and affiliated with the CoE ProTed. The study provided detailed description of ProTed's main agenda in developing an integrated TTP included a *"coherent study design where scientific subjects, school subjects, pedagogy, subject didactics, theory, and practice constitute a whole as a basis for teaching as a profession"* (ProTed, 2020). The goals are divided into five WPs that are responsible for innovation, dissemination, and implementation of the research-based knowledge from the experts and academics of the Centre. The aim of this paper has been to explore the experiences of PSTs to elaborate their development of PDC, thus for this reason, this study is confined to the first three WPs of the ProTed namely, Progression and cohesion, University school and professional practice and lastly, Teacher education for digital future.

The aims and goals are translated and implemented into the Oslo Model at UiO, where the PSTs participate in various learning designs to develop their PDC. The ProTed aims to engage students in *"designing technology rich learning environments and trajectories where they integrate disciplinary and professional expertise as well as their experiences from practice periods"* (Lund & Eriksen, 2016a, p. 67). Firstly, the WP1 of ProTed specifies an active collaboration between the five faculties, and ensuring that professors, mentors, and pedagogical professionals work together to enhance the PDC of the PSTs. Additionally, the PSTs confirmed that PDCMs offered both didactical and essential pedagogical theoretical elements connected to the use of digital tools throughout the course of TTP at UiO.

Secondly, WP2 encapsulates the University School Concept and the Mentoring Program (ProTed, 2017, 2018). The PSTs mentioned that the practicum enabled them to practice and learn about using digital tools in classrooms as teachers. On this subject, the PSTs mentioned that they were assisted by their mentors, who gave them a guided tour of the digital infrastructure and the pertinent digital tools in the school. During the PSTs' campus-based courses, PDCM has been the most important module for the PSTs. This course begins during the third semester, as shown in the Oslo Model (Section 3.4.1) and has been integrated into the five-year TTP. The dimensions of the integrated learning designs feature the Test Mapping Professional Digital Competence 1, 2, and 3; Digital Learning Modules 1, 2, 3, and 4; and Technology in Subject Area and Research (ProTed, 2017). The Oslo Model revealed that the PSTs were educated regarding various uses of digital technology in different forms and at different times, mainly by their subject and pedagogy professors during their five-year TTP.

As PSTs revealed that they were still required to learn about the digital tools and digital infrastructure at school as their campus-based courses only provided them the theoretical knowledge of integrating digital tools for teaching. The study resonated with other research on the gap between the theoretical knowledge or the curriculum taught at universities and the practical expectation of integrating digital tools as teachers (Gueudet & Pepin, 2019; Ruiz, 2019). In a similar vein, the data also revealed that the PSTs did not claim to integrate the theoretical knowledge or establish a connection between their theoretical knowledge with their practical integration of digital tools during their internships. Furthermore the PSTs commented on the importance of modeling , and the PSTs claimed that practices of their professors and mentors posed a positive

impact on their digital competencies. (Lund, Furberg, et al., 2014b; Røkenes & Krumsvik, 2016; Thoring et al., 2018).

Beyond this, WP3 offer the digital learning environment including digital assessment formats, LMS and the 'flipped classrooms.' The main aim for video-based assessment and digital exams are to enhance the competency of PSTs in integrating digital tools for assessment and supervision. These unconventional forms of assessment required the inclusion of digital tools to assess the PTSs' pedagogical, digital, and disciplinary knowledge. Video-based assessment, which is known as Video-based Mentoring in Practice Placement in Teacher Education (VVPL), can provide metacognition by enabling PSTs to be critical and reflect of their teaching practices. According to Røkenes and Krumsvik, metacognition enables teachers to be critical of their practices as teachers and as PSTs confirmed that they were able to reflect, learn and practice their pedagogy and digital competency (2016). This format was designed to supplement the PSTs' teaching practices with their formal university education. That is, this procedure merged their enactment of pedagogy in their internships with the theoretical concepts introduced by their professors. As in previous studies, the video-bases assessment is seen to merge three agents—PSTs, mentors, and university professors—to provide PST constructive feedback and a digital environment where they could engage with digital tools to display their learning trajectories (Brown et al., 2019; Lund, Furberg, et al., 2014a; Lund, Bakken et al., 2014). The PSTs claimed that the video-based assessment enabled them to reflect on their teaching practices and provided them with the feedback from their mentors, university professors and their peers.

Furthermore, the digital exams were aimed to test the PSTs' knowledge and awareness of demonstrating their knowledge about pedagogical concepts using a digital medium. Although the PSTs stated a positive experience with the digital exam, they criticized the inadequate guidance given to them regarding the four-hour exam. The findings resonated with those of a study conducted in 2019, which also focused on three individual cases and concluded that PSTs complained about a lack of information on the genre of writing, assessment criteria, and guidance before the exam (Adalberon et al., 2019). However, digital exams are now a compulsory part of the TTP across Norway (ProTed 2016), acclaimed for linking digital technologies to utilize analytical and didactical concepts for the development of pedagogical and digital knowledge among the new student teachers (Lund, et al., 2014).

Lastly, learning designs such as incorporating LMS to form a Flipped-Classroom setup employ digital platforms to collaborate, organize, and upload assignments and to connect and to help PSTs communicate with peers, teachers, and administrators. In this study, ProTed aimed to actively integrate LMS for the PSTs to experience the advantages of "uni-directional delivery of course material regardless of space and time" (ProTed, 2017, p.10). Although the PSTs regarded LMS as a user-driven digital platform, they were also able to recognize the affordances of LMS to organize, inform, communicate, and provide feedback on its assessment. The PSTs were able to engage with LMS at school and university and were able to reflect on the positive and challenges of flipped classrooms and mentioned their preference of blended digital learning environments. To conclude, we see that the there is an adequate compliance with the goals and aims of ProTed and the experiences of the PSTs and the data shows that the PSTs are learning from the extensive learning designs that are targeting to enhance their PDC.

7.1.2 Development of Pre-service Teachers' Professional Digital Competency

The development of the PDC began with the enrollment of the PSTs into their TTPs. Their development of PDC in this study was analyzed using Krumsvik´s Teacher's Digital Competency Model and the essence of this model states the following:

> Digital competence is the teachers/TEs' [teacher educators'] proficiency in using ICT in a professional context with good pedagogic-didactic judgement and his or her awareness of its implications for learning strategies and the digital *Bildung* of pupils and students. (Krumsvik, 2012, p. 466; Krumsvik, 2011, pp. 44–45)

This framework provides insight into the mental and practical journey starting from the adoption, adaption, appropriation, and innovation of various elements that contribute to PSTs' digital competency. The experiences of the PSTs demonstrate the different levels of self-awareness and practical proficiency of integrating digital tools as teachers. However, as the PSTs are still in their formal years of TTP, the PSTs showed their solid basic digital skills, and they were able to adopt various forms of digital tools in their classrooms.

Additionally, ICT didactics are related to the understanding and integration of digital tools for teaching and learning subject specific knowledge. In this study, the PSTs mentioned that they had

taken formal courses about the didactical use of digital tools for teaching subject-specific knowledge, and they claimed to practice pertinent didactical tools during their internship. Most of the PSTs adapted to the digital tools that existed in their learning and teaching environments. With their limited experience, the data revealed that PSTs are learning and experimenting with various forms of didactical tools and are themselves motivated in integrating tools that aligns with their pedagogical purposes. The PSTs mentioned the importance of selecting the digital tools and they seemed conscious about the epistemology of digital tools where the technology supports the pedagogical aims, and the content becomes visible. From the concepts of mastery and appropriation by Lave and Wenger (1991), the PSTs at the point are mastering the use of digital tools for teaching. It can be said that with more experience, the PSTs will be able to appropriate digital tools in the classroom for teaching a specific subject.

The integration of digital tools for assessment, feedback and classroom management are notions that comes under the category digital learning strategies mentioned in the Teacher's Digital Competence Model proposed by Krumsvik (2012). From the model, digital learning strategies are used to develop scaffolding, knowledge construction, and metacognition using digital tools. In this study, the PSTs claimed that they incorporated OneNote, Duolingo, Showbie, and Google Forums to manage, construct knowledge, and reinforce knowledge. Furthermore, the PSTs mentioned that they were able to adapt digital tools for learning strategies, although some of the PSTs mentioned posting resources on LMS to enhance the prior knowledge of the students before starting a new topic. During their internships, the PSTs mentioned that they were able to observe the response of their students of their initiatives. The data also showed that with the practical integration of digital assessment tools, the PSTs exhibited their competency at the appropriation level as they reflected on their deeper understanding for integrating tools such as Kahoot or Duolingo and why for some the tools such as Google Docs and OneNote proved to be more suitable.

This work led to the last stage of digital *Bildung*, that provides the meta-perspective of the three previous notions namely, basic digital competency, didactical-ICT competency and learning strategies. It portrays a holistic understanding about digital integration and the development of digital identity among the PSTs. Krumsvik argues that digital *Bildung* is influenced by the user's engagement with digital tools in this digitalized society (2010,2014). Moreover, the digital *Bildung* also refers to the awareness of ethical considerations, social implications, and digital technology's effects on human development. The study explores the experiences and self-reported perceptions

of PSTs that claimed to have acquired the theoretical and practical competency in integrating digital tools. They also claimed to have adequate digital competency as teachers. At the *Bildung* level, the PSTs are expected to reflect on their theoretical knowledge by contemplating and connecting their teaching practices with theoretical reasoning. Furthermore, PSTs have been relying on their personal perceptions rather than displaying a more vivid pedagogical reasoning with regards to the issues related to ethical issues related to integrating technological tools in the classrooms. The PSTs claimed to be conscious about the safety and privacy of using the internet, and through these experiences, they are developing their digital identities.

In essence, the digital competency is a harmonious blend of operational skills, skills for creating or modifying the digital products. Additionally, this trait relied on the PSTs' judgment regarding the integration of various digital tools.

> Digital skills involve being able to use digital tools, media and resources efficiently and responsibly, to solve practical tasks, find and process information, design digital products and communicate content. Digital skills also include developing digital judgment by acquiring knowledge and promising strategies for using the internet. (Mentioned in Krumsvik, 2011, p. 43)

Thus, the PSTs were aware that students do not depend on the simple technology of writing with a pen and paper, but they expected a higher level of digital competency than their teachers along with their authority of the subject they teach. While the PSTs claimed to have been adapting most of the digital tools in the teaching and learning environment, however they lack the ability to reflect on the theoretical concepts and connecting it to their practices at the *Bildung* level. Their critical awareness in implementing their theoretical knowledge into practice is limited. With the frequent integration of digital tools by the teachers and the students, the PSTs are learning to elaborately discuss social and ethical issues in integrating digital tools for pedagogical aims.

7.2: Conclusion

This study was conducted against the backdrop of the existing literature on teacher education in the Norwegian context on the issues related to the development of the PDC of PSTs. Thus, this study explored the self-reported experiences of the PSTs enrolled in a TTP, associated with a CoE,

ProTed. Unlike other studies related to PSTs' experiences or the impact of the national and institutional on the quality of teacher education, this study explored the development of PDC by analyzing the experiences of PSTs enrolled in TTP affiliated with CoE.

The primary finding from the interviews revealed that the TTP employs a wide range of learning designs to support and develop PDC among PSTs to prepare them as future teachers. As the participants in this study were PSTs, naturally they do not portray a high level of PDC analyzed using Teacher's Digital Competence Model by Krumsvik (2012). However, the data revealed that the PSTs' experiences formed the foundation of their knowledge acquisition as they were actively adapting various digital tools in their learning and teaching environments. With the inclusions of digital tools in the education sector, these PSTs revealed to have positive attitudes and motivation for the integration of digital tools.

With the huge innovational push from the CoE to incorporate modern learning designs, the diversity of experiences connected to the use of digital tools among the PSTs revealed that their TTP is actively engaging PSTs with various digital tools and resources. The study concluded by observing an adequate compliance with the goals and objectives of ProTed in the context of PDC and what the PSTs experienced when exposed to these set courses. The PSTs reported to have significant self-awareness of the importance the digital world plays in society and especially in teaching and learning environments. Additionally, PSTs' assumption about their self-evaluated digital competency would be sufficient for their profession as teachers contradicts their professional requisite to be competent with the use of ICT Didactics and pedagogical digital knowledge. With their solid basic digital skills, the PSTs stated that they readily adapt the digital infrastructure during their internships with assistance from their mentors.

The discussion initiated in this paper demonstrates the need for a more systematic approach to explain the need for the uptake and use of digital tools in merging both theoretical and practical competencies in TTP. From the evidence gathered by this study, we can say that the PSTs missed out on deeper understanding and connecting the theoretical with the practical implementation. The participants of this study claimed to be adapting the prevalent digital tools without linking them to their theoretical foundations. Furthermore, the PSTs are also seen to be relying on their personal judgement rather than making pedagogical judgment with clear theoretical and pedagogical reasoning. The study recommends the incorporation of learning designs that

integrate both theoretical and practical digital knowledge and demonstrating the linking for the PSTs to develop digital *Bildung*.

7.3: Limitation

The study was designed as a qualitative case study to provide insight into the experiences of the PSTs as they develop their digital competency during their formal TTP. The study is conducted from the PST's point of view as self-reports and therefore not representative. Moreover, these perceptions have to be evaluated in relation to the specific context at UiO affiliated with CoE, ProTed. Due to the limited sample size, these perceptions and experiences are not necessarily transferable to other universities. Beyond this, the sample of the study was restricted by gender and the subjects the participants taught. That is, all the participants were female, and five of them were language teachers, whereas one of them was a mathematics and physics PST. Nonetheless the study can be complemented with academic's point of view or a larger random sample to provide meaningful and valuable information for those involved in ProTed and UiO.

Furthermore, this study was conducted during the pandemic, so it was challenging to recruit participants and to conduct face-to-face interviews. To circumvent these issues, the respondents were self-recruited on Facebook, and the interviews were conducted via Zoom. The sampling method was also self-selected and greatly influenced the findings of the thesis. With a larger or more purposeful sample, the observations of students in their classrooms and internships could have impacted the findings of the thesis. Additionally, the study had limited external validity. As the study constituted a specific case, based on the Oslo Model of ProTed, it was highly customized and thus very specific to the CoE and the national context. Even for other countries, such as those in the EU and the EEA, a careful inspection would be needed before extending the findings of the ProTed study.

Furthermore, the study was restricting to qualitative interviews and scrutinization of the documents responding to the aims of the study. Thus, apart from the semi-structured interviews, the inclusion of participant observations, in-depth interviews, and fully structured questionnaires could have enhanced the theoretical contributions. Similarly, the use of quantitative methods in tandem or in the form of research triangulation could have helped to develop a synthesis of philosophical debates or a deeper understanding of the dynamics of the subject under discussion.

7.4 Recommendations for Further Research

The study was focused on the experiences of PSTs, a recommendation would be to conduct a similar study where the perceptions are taken from the academics to explore the efforts and aims the academics have to develop the PDC among the PSTs. furthermore, a comparative study can be conducted to see the difference how the science students and social sciences students experience learning designs to develop their PDC. This study can reveal how the PSTs develop their Didactical ICT-competency during their TTP.

Furthermore, the concept of digital *Bildung* among the PSTs and TEs can be compared to see how the teachers develop their digital identities as teachers. furthermore, a similar study can be conducted from the mentor's perspective to explore their perceptions about the importance of self-awareness and practical proficiency can be enhanced among the PSTs.

Additionally, because this study was qualitative, quantitative methods could be employed to generate quantitative data to portray the impact of learning designs on the PDC of the PSTs. Moreover, another recommendation would be to employ *"the concept of transformative agency"* as a framework for analyzing the experiences and engagement of the PSTs (Lund & Eriksen, 2016b).

References

Agyei, D., & Voogt, J. (2011). Exploring the potential of the will, skill, tool model in Ghana: Predicting prospective and practicing teachers' use of technology. *Computers & Education*, *56*, 91–100. https://doi.org/10.1016/j.compedu.2010.08.017

Anderson, J. (2010). *ICT transforming education: A regional guide.* UNESCO Asia and Pacific Regional Bureau for Education.

Argyris, C., & Schon, D. A. (1978). *Organizational Learning: A Theory of Action Perspective*. AddisonWesley.

Balyer, A., & Oz, O. (2018). ACADEMICIANS' VIEWS ON DIGITAL TRANSFORMATION IN EDUCATION. *International Online Journal of Education and Teaching*, *5*(4), 809–830.

Bates, A. W. (Tony). (2015). Teaching in a Digital Age. *Open Educational Resources Collection*. https://irl.umsl.edu/oer/6

Bdiwi, R., Runz, C. de, Faiz, S., & Cherif, A. A. (2019). Smart learning environment: Teacher's role in assessing classroom attention. *Research in Learning Technology*, *27*. https://doi.org/10.25304/rlt.v27.2072

Beetham, H., & Sharpe, R. (2007). *Rethinking Pedagogy for a Digital Age: Designing and Delivering ELearning*. Routledge.

Bell, R. L., Maeng, J. L., & Binns, I. C. (2013). Learning in context: Technology integration in a teacher preparation program informed by situated learning theory. *Journal of Research in Science*
Teaching, *50*(3), 348–379. https://doi.org/10.1002/tea.21075

Brinkmann, S., & Kvale, S. (2015). *InterViews: Learning the Craft of Qualitative Research Interviewing* (Third edition). SAGE Publications, Inc.

Brown, J., Brown, L., Coles, A., & Helliwell, T. (2019). Learning to Teach Mathematics: The Lesson DeBrief Conversation. *International Handbook of Mathematics Teacher Education: Volume 2*,
85–108. https://doi.org/10.1163/9789004418967_004

Brox, H. (2017). What's in a wiki? *Nordic Journal of Digital Literacy*, *12*(04), 129–142. https://doi.org/10.18261/issn.1891-943x-2017-04-03

Bryman, A. (2016). *Social Research Methods* (5 edition). Oxford University Press.

Creswell, J. W. (2003). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE Publications.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches* (4th edition). SAGE Publications, Inc.

Creswell, J. W., & Poth, C. N. (2017). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (4th edition). SAGE Publications, Inc.

Daymon, C., & Holloway, I. (2005). *Qualitative Research Methods in Public Relations and Marketing Communications*. Routledge.

Drent, M., & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively? *Computers & Education*, *51*, 187–199. https://doi.org/10.1016/j.compedu.2007.05.001

Duncan-Howell, J. (2012). Digital Mismatch: Expectations and Realities of Digital Competency amongst Pre-Service Education Students. *Australasian Journal of Educational Technology*, *28*(5), 827–840. https://doi.org/10.14742/ajet.819

Dwyer, D. C. (1991). Changes in Teachers' Beliefs and Practices in Technology-Rich Classrooms. *Educational Leadership*, *48*(8), 45–52.

Earle, R. S. (2002). The Integration of Instructional Technology into Public Education: Promises and Challenges. *Educational Technology*, *42*(1), 5–13. JSTOR.

Engestrom, Y. (1987). *Learning by Expanding: An Activity-Theoretical Approach to Developmental Research* (2nd ed.). Cambridge University Press. https://doi.org/10.1017/CBO9781139814744

Engeström, Y., Miettinen, R., Punamäki-Gitai, R.-L., & International Congress for Research on Activity Theory. (1999). *Perspectives on activity theory*. Cambridge University Press. https://doi.org/10.1017/CBO9780511812774

Erstad, O. (2010). Educating the Digital Generation. *Nordic Journal of Digital Literacy*, *5*(01), 56–71.

European Commission. (2018). *Boosting teacher quality: Pathways to effective policies.* https://publications.europa.eu/en/publication-detail/-/publication/95e81178-896b-11e8ac6a-01aa75ed71a1/language-en/format-PDF

Ferrari, A., Punie, Y., Brečko, B. N., & Institute for Prospective Technological Studies. (2013). *DIGCOMP: A framework for developing and understanding digital competence in Europe.* Publications Office. http://dx.publications.europa.eu10.2788/52966

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, *12*(2), 219–245. https://doi.org/10.1177/1077800405284363

Fosnot, C. T. (2013). *Constructivism: Theory, Perspectives, and Practice, Second Edition*. Teachers College Press.

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *Internet and Higher Education*, *7*(2), 95–105.

Giles, R. M., & Kent, A. M. (2016). An Investigation of Preservice Teachers' Self-Efficacy for Teaching with Technology. *Asian Education Studies*, *1*(1), 32. https://doi.org/10.20849/aes.v1i1.19

Groth, L. A., Dunlap, K. L., & Kidd, J. K. (2007). Becoming Technologically Literate through Technology Integration in PK-12 Preservice Literacy Courses: Three Case Studies. *Reading Research and Instruction*, *46*(4), 363–386.

Gudmundsdottir, G. B., & Hatlevik, O. E. (2018). Newly qualified teachers' professional digital competence: Implications for teacher education. *European Journal of Teacher Education*, *41*(2), 214–231. https://doi.org/10.1080/02619768.2017.1416085

Gueudet, G., & Pepin, B. (2019). Digital curriculum resources in/for mathematics teacher learning. A documentational approach perspective. In S. Llinares & O. Chapman (Eds.), *International Handbook for Mathematics Teacher Education*. Brill. https://doi.org/10.1163/9789004418967_006

Hammerness, K. (2013). Examining Features of Teacher Education in Norway. *Scandinavian Journal of Educational Research*. https://www.tandfonline.com/doi/abs/10.1080/00313831.2012.656285

Helland, K., Kelentrić, M., & Arstorp, A.-T. (2017). *Professional Digital Competence Framework for Teachers*. https://www.udir.no/in-english/professional-digital-competence-framework-forteachers/

Hellström, T. (2018). Centres of Excellence and Capacity Building: From Strategy to Impact. *Science and Public Policy*, *45*(4), 543–552. https://doi.org/10.1093/scipol/scx082

Helseth, I. A., & Bråten, H. (2018). *Paper presented in track 1 Teaching and Learning at the*. 15.

Hutchins, E. (1995). *Cognition in the Wild*. MIT Press.

Instefjord, E., & Munthe, E. (2016). Preparing pre-service teachers to integrate technology: An analysis of the emphasis on digital competence in teacher education curricula. *European Journal of Teacher Education*, *39*(1), 77–93. https://doi.org/10.1080/02619768.2015.1100602

Israel, M., & Hay, I. (2006). *Research Ethics for Social Scientists* (1st edition). SAGE Publications Ltd.

Jahreie, C. F., & Ludvigsen, S. R. (2007). PORTFOLIOS AS BOUNDARY OBJECT: LEARNING AND CHANGE IN TEACHER EDUCATION. *Research and Practice in Technology Enhanced Learning*,

02(03), 299–318. https://doi.org/10.1142/S179320680700035X

Jimoyiannis, A., & Komis, V. (2006). *FACTORS AFFECTING TEACHERS' VIEWS AND PERCEPTIONS OF ICT IN EDUCATION*. 9.

Jonassen, D. H. (1991). Objectivism versus constructivism: Do we need a new philosophical paradigm? *Educational Technology Research and Development*, *39*(3), 5–14. https://doi.org/10.1007/BF02296434

Kastberg, S. (2005). *Research On Graphing Calculators at the Secondary Level: Implications for Mathematics Teacher Education*.

Keller, L. D., Lid, S. E., & Helseth, ngvild A. (2015). *Researchas foundation for education: Centres of Excellence and good practices*. https://www.nokut.no/globalassets/nokut/rapporter/sfu/keller_lid_helseth_research_as_fo undation_for_education_centres_of_excellence_and_good_practices_03-2015-1.pdf

Kirschner, P., Martens, R., & Strijbos, J.-W. (2004). *CSCL in higher education?: A framework for designing multiple collaborative environments*. 3–30.

Klette, K., & Hammerness, K. (2016). Conceptual Framework for Analyzing Qualities in Teacher Education: Looking at Features of Teacher Education from an International Perspective. *Acta Didactica Norge*, *10*(2), 26–52. https://doi.org/10.5617/adno.2646

Kozma, R. B., Isaacs, S., & Unesco (Eds.). (2011). *Transforming education: The power of ICT policies*. UNESCO.

Krumsvik, R. J. (2008). *Educational Technology, Epistemology and Discourses in Curricula in Norway*. *5*(5), 1.

Krumsvik, R. J. (2011). Digital competence in the Norwegian teacher education and schools. *Högre Utbildning*, *1*(1), 39–51.

Krumsvik, R. J. (2012). The Digital School and teacher education in Norway. In R. Schulz-Zander, B. Eickelmann, H. Moser, H. Niesyto, & P. Grell (Eds.), *Jahrbuch Medienpädagogik 9* (pp. 455–480). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-94219-3_20

Krumsvik, R. J. (2014). Teacher educators' digital competence. *Scandinavian Journal of Educational Research*, *58*(3), 269–280. https://doi.org/10.1080/00313831.2012.726273

Krumsvik, R. J., Berrum, E., Jones, L. Ø., & Gulbrandsen, I. P. (2019). *IMPLEMENTING TABLETS IN NORWEGIAN PRIMARY SCHOOLS: EXAMINING OUTCOME MEASURES IN THE SECOND COHORT*. 29.

Krumsvik, R. J., Jones, L. Ø., Øfstegaard, M., & Eikeland, O. J. (2016). Upper Secondary School Teachers' Digital Competence: Analysed by Demographic, Personal and Professional Characteristics. *Nordic Journal of Digital Literacy*, *11*(03), 143–164. https://doi.org/10.18261/issn.1891-943x-2016-03-02

Larkin, K., Jamieson-Proctor, R., & Finger, G. (2012). TPACK and Pre-Service Teacher Mathematics Education: Defining a Signature Pedagogy for Mathematics Education Using ICT and Based on the Metaphor "Mathematics Is a Language." *Computers in the Schools*, *29*(1–2), 207–226. https://doi.org/10.1080/07380569.2012.651424

Larsen, K. (2019). Managing the complexity of centres of excellence: Accommodating diversity in institutional logics. *Tertiary Education and Management*. https://doi.org/10.1007/s11233019-09053-w

Lave, J., & Wenger, E. (1991a). *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press.

Lave, J., & Wenger, E. (1991b). *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press.

Lei, J. (2009). *Digital Natives As Preservice Teachers: What Technology Preparation Is Needed?* 11.

Lincoln, Y. S., & Guba, E. G. (1986). But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation. *New Directions for Program Evaluation*, *1986*(30), 73–84. https://doi.org/10.1002/ev.1427

Lund, A., Bakken, J., & Engelien, K. L. (2014). Teacher education as design: Technology-rich learning environments and trajectories. *Seminar.Net*, *10*(2), Article 2. https://journals.hioa.no/index.php/seminar/article/view/2369

Lund, A., & Eriksen, T. M. (2016). *Teacher Education as Transformation: Some Lessons Learned from a Center for Excellence in Education*. https://doi.org/10.5617/adno.2483

Lund, A., Furberg, A., Bakken, J., & Engelien, K. L. (2014). What Does Professional Digital Competence Mean in Teacher Education? *Nordic Journal of Digital Literacy*, *9*(04), 280–298.

Malterud, K. (2012). Systematic text condensation: A strategy for qualitative analysis. *Scandinavian Journal of Public Health*, *40*(8), 795–805. https://doi.org/10.1177/1403494812465030

Maxwell, J. A. (2013). *Qualitative Research Design: An Interactive Approach* (3rd edition). SAGE Publications, Inc.

Miller, D. C., & Salkind, N. J. (2002). *Handbook of Research Design and Social Measurement*. SAGE.

Ministry of Defence. (2013, March 1). *Meld. St. 14 (2012-2013)* [Stortingsmelding]. Government.No. https://www.regjeringen.no/en/dokumenter/meld.-st.-14-2012-2013/id715809/

Ministry of Education and Research. (2006). *Knowledge Promotion: The Quality Framework*. https://www.udir.no/globalassets/upload/larerplaner/fastsatte_lareplaner_for_kunnskapslo eftet/5/prinsipper_lk06_eng.pdf

Ministry of Education and Research. (2007, March 29). *Education Act* [Lov]. Education Act. https://www.regjeringen.no/en/dokumenter/education-act/id213315/

Ministry of Education and Research. (2010, March 3). *National Curriculum Regulations for Differentiated Primary and Lower Secondary Teacher Education Programmes for Years 1 – 7 and Years 5 – 10* [Forskrift]. National Curriculum Regulations for Differentiated Primary and Lower Secondary Teacher Education Programmes for Years 1 – 7 and Years 5 – 10; regjeringen.no. https://www.regjeringen.no/en/dokumenter/national-curriculumregulations-for-diff/id594357/

Ministry of Education and Research. (2018, February 19). *Digitalisation strategy for the higher education sector 2017-2021* [Report]. Digitalisation Strategy for the Higher Education Sector 2017-2021. https://www.regjeringen.no/en/dokumenter/digitalisation-strategy-for-thehigher-education-sector-2017-2021/id2571085/

Ministry of Education andResearch. (2018). *Meld. St. 4 (2018–2019)*. regjeringen.no. https://www.regjeringen.no/en/dokumenter/meld.-st.-4-20182019/id2614131/

Ministry of Foreign Affairs. (2018, September 20). *Digital strategy for Norwegian development policy* [Plan]. Government.No. https://www.regjeringen.no/en/dokumenter/digitalstrategy/id2608197/

Mirriahi, N., & Alonzo, D. (2015). Shedding Light on Students' Technology Preferences: Implications for Academic Development. *Journal of University Teaching and Learning Practice*, *12*(1). https://eric.ed.gov/?id=EJ1054629

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record*, *108*(6), 1017–1054.

Nerantzi, C., & Beckingham, S. (2015). Scaling up Open CPD for Teachers in Higher Education: A Snowballing Approach. *Journal of Perspectives in Applied Academic Practice*, *3*, 109–121. https://doi.org/10.14297/jpaap.v3i1.148

Niess, M. (2008). Guiding preservice teachers in developing TPCK. *Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators*, 223–250.

Niess, M. L. (2005). Preparing teachers to teach science and mathematics with technology: Developing a technology pedagogical content knowledge. *Teaching and Teacher Education*, *21*(5), 509–523. https://doi.org/10.1016/j.tate.2005.03.006

NOKUT. (2015). *Proted mid-term Evaluation Report*. https://www.nokut.no/siteassets/sfu/proted_mid-term_evaluation_report_2015.pdf

OECD. (2017). *Digital Government Review of Norway*. OECD Publishing. https://doi.org/10.1787/9789264279742-en

Olofsson, A. D., Lindberg, J. O., Fransson, G., & Hauge, T. E. (2011). Uptake and Use of Digital Technologies in Primary and Secondary Schools – a Thematic Review of Research. *Nordic Journal of Digital Literacy*, *6*(04), 207–225.

Ottestad, G., Kelentrić, M., & Guðmundsdóttir, G. B. (2014). Professional Digital Competence in Teacher Education. *Nordic Journal of Digital Literacy*, *9*(04), 243–249.

Pamuk, S. (2012). Understanding preservice teachers' technology use through TPACK framework. *Journal of Computer Assisted Learning*, *28*(5), 425–439. https://doi.org/10.1111/j.13652729.2011.00447.x

Paraskeva, F., Bouta, H., & Papagianni, A. (2008). Individual characteristics and computer selfefficacy in secondary education teachers to integrate technology in educational practice. *Computers & Education*, *50*(3), 1084–1091.

Patton, M. Q. (2002). *Qualitative Research & Evaluation Methods*. SAGE.

Pettersson, F. (2018). On the issues of digital competence in educational contexts – a review of literature. *Education and Information Technologies*, *23*(3), 1005–1021. https://doi.org/10.1007/s10639-017-9649-3

Phillips, D. C. (1995). The Good, the Bad, and the Ugly: The Many Faces of Constructivism. *Educational Researcher*, *24*(7), 5–12. https://doi.org/10.3102/0013189X024007005

Polanyi, M. (1966). *The Tacit Dimension*.

ProTed. (n.d.). *ProTed—Centre for Professional Learning i Teacher Education—ProTed—Centre for Professional Learning in Teacher education*. Retrieved March 29, 2020, from https://www.uv.uio.no/proted/english/index.html ProTed. (2014). *Annual Report 2014*. https://www.nokut.no/siteassets/sfu/arsrapporter/annual_report_2014_proted.pdf

ProTed. (2015). *Annual Report 2015*. https://www.nokut.no/siteassets/sfu/arsrapporter/annual_report_2015_proted.pdf

ProTed. (2016). *Annual Report 2016*. https://www.nokut.no/siteassets/sfu/arsrapporter/annual_report_2016_proted.pdf

ProTed. (2017). *Annual Report 2017*. https://www.uv.uio.no/proted/om/arsrapporter/annualreport-for-proted_2017.pdf

ProTed. (2018). *Annual Report 2018*. https://www.uv.uio.no/proted/om/arsrapporter/annualreport-for-proted-2018-.pdf

ProTed. (2019). *Annual Report 2019*. https://www.uv.uio.no/proted/om/arsrapporter/annualreport-ProTed-2019.pdf

ProTed. (2020). *About ProTed—ProTed—Centre for Professional Learning in Teacher education*. https://www.uv.uio.no/proted/english/about/index.html

Redecker, C., & Punie, Y. (2017). *European framework for the digital competence of educators: DigCompEdu.* https://publications.europa.eu/en/publication-detail/-/publication/fcc33b68d581-11e7-a5b9-01aa75ed71a1/language-en/format-PDF

Røkenes, F. M. (2016). Digital storytelling in teacher education: A meaningful way of integrating ICT in ESL teaching. *Acta Didactica Norge*, *10*(2), 311–328. https://doi.org/10.5617/adno.2431

Røkenes, F. M., & Krumsvik, R. J. (2014). Development of Student Teachers' Digital Competence in Teacher Education—A Literature Review. *Nordic Journal of Digital Literacy*, *9*(04), 250–280.

Røkenes, F. M., & Krumsvik, R. J. (2016). Prepared to teach ESL with ICT? A study of digital competence in Norwegian teacher education. *Computers & Education*, *97*(C), 1–20. https://doi.org/10.1016/j.compedu.2016.02.014

Rosch, E., & Lloyd, B. B. (1978). *Cognition and categorization*.

Ruiz, A. (2019). Technology as a Curriculum Instrument. *The International Handbook of Mathematics Teacher Education*. https://www.academia.edu/41513124/Technology_as_a_Curriculum_Instrument

Säljö, R. (2001). *Læring i praksis: Et sosiokulturelt perspektiv*. J.W. Cappelens forlag.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. Basic Books.

Shimada, A., Minematsu, T., & Yamada, M. (2019). Advanced Tools for Digital Learning Management Systems in University Education. In N. Streitz & S. Konomi (Eds.), *Distributed, Ambient and Pervasive Interactions* (pp. 419–429). Springer International Publishing. https://doi.org/10.1007/978-3-030-21935-2_32

Shulman, L. (1987). Knowledge and Teaching: Foundations of the New Reform. *Harvard Educational Review*, *57*(1), 1–23. https://doi.org/10.17763/haer.57.1.j463w79r56455411

Silverman, D. (1997). *Qualitative Research: Theory, Method and Practice*. SAGE Publications.

Simons, H. (2009). *Case Study Research in Practice*. SAGE.

The Norwegian Directorate for Education and Training. (2012). *Framework for Basic Skills*. https://www.udir.no/in-english/Framework-for-Basic-Skills/

The Research Council of Norway. (2012). *Research in Information and Communication Technology in Norway*. https://www.forskningsradet.no/siteassets/publikasjoner/1253977267512.pdf

Thoring, A., Rudolph, D., & Vogl, R. (2018). The Digital Transformation of Teaching in Higher Education from an Academic's Point of View: An Explorative Study. In P. Zaphiris & A. Ioannou (Eds.), *Learning and Collaboration Technologies. Design, Development and Technological Innovation* (pp. 294–309). Springer International Publishing. https://doi.org/10.1007/978-3-319-91743-6_23

Tømte, C. E. (2015). Educating Teachers for the New Millennium? - Teacher training, ICT and digital competence. *Nordic Journal of Digital Literacy*, *10*(Jubileumsnummer), 138–154.

Torrisi-Steele, G., & Drew, S. (2013). The literature landscape of blended learning in higher education: The need for better understanding of academic blended practice. *International Journal for Academic Development*, *18*(4), 371–383. https://doi.org/10.1080/1360144X.2013.786720

Valtonen, T., Pöntinen, S., Kukkonen, J., Dillon, P., Väisänen, P., & Hacklin, S. (2011). Confronting the technological pedagogical knowledge of Finnish Net Generation student teachers. *Technology, Pedagogy and Education*, *20*, 3–18. https://doi.org/10.1080/1475939X.2010.534867

Vestøl, J. M. (2016). Design, Integration, and Quality. Teacher Education from the perspective of ProTed, a Norwegian Centre of Excellence in Education. *Acta Didactica Norge*, *10*(2), 73–91. https://doi.org/10.5617/adno.2394

Vygotsky, L. S. (1980). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.

Wertsch, J. (1998). Mind as Action. *Mind as Action*. https://doi.org/10.1093/acprof:oso/9780195117530.001.0001

Wespel, J., Orr, D., & Jaeger, M. (2013). Implications of Excellence in Research and Teaching. *International Higher Education*, *72*, 13–15.

https://doi.org/10.6017/ihe.2013.72.6106 Yin, R. K. (2009). *Case Study Research: Design and Methods*. SAGE. Yin, R. K. (2014). *Case Study Research*. SAGE Publications.

Appendix

Pre-questionnaire

This questionnaire was posted on Calendly, the web developer used for the participants to select the date for the interview via Zoom.

1. What is your name?
2. State your Email for further information about the study program.
3. How old are you?

- 20-25
- 26-30
- 31-35
- 36-40

4. What Year of Teacher Education Program are you in now?
5. When did you start the Teacher Education Program?
6. What are the main subjects that you will be able to teach in service?
7. Have you studied ICT (Information and Communication Technology) in the "Videregående skole"?
8. Have you studies or have experience in the area of ICT before you started your Teacher Education Program?

Interview Guide

Semi-structed Interview Guide

Main Points of Discussion	Descriptive questions	Analytical Questions
• **Exaggeration Vs Need**	• If exaggeration: Why do	• If exaggeration: Why? • If need: Why?
PROMO	• What can you tell me about Promo, the mentor program? • How is it integrated in your study design?	• What do you think are the main aims of this program? • How does it help the mathematics pre-service teachers
Teacher Practice: fieldwork	• How many days of fieldwork have you finished? • What is a day like on field? • Are there digital tools that you have encounter on the field for the first time? • How is the fieldwork assessed?	• What is your experiencing with using digital tools on the field? • Do you plan lessons? Do you include the various digital resources or digital tools that will be integrated for a certain topic? • What is the purpose digital tools serve for the mathematics teacher in the field?
Professional digital competency modules: Campus based	• Could you tell me about the PDC modules? • Do the mathematics teachers have subject-based knowledge?	• To what extent these theories are applicable in the classrooms (fieldwork) • Does the theories matter while planning the lessons?
Video based assessment	What has been your experience with the Video-based assessment?	What Are the Challenges? What are the learning opportunities from this?
Digital Exams	• What are digital Exams? • Can you tell me how are these different from regular exams?	• What could be the learning outcomes of digital exams? • In your experience, do they contribute to awareness or practical proficiency of the students in terms of assessment? •
Flipped classrooms	• Have you experienced flipped classrooms? • If yes: What was your experience with the method •	What is the role of the teacher? How than these be regulated
ICT subject Didactics	How is ICT didactics integrated in your study design?	How are the competency assessed for the teachers?

	What are the most helpful tools?	
	Do you have ample knowledge and experience?	
Integration of Technology	In your experience what is the role of digital tools? How much does the teacher training program helped you in this respect	How does it contribute to the learning? What are the most essential skills?
LMS and other modes of communication	What are the different platforms	LMS at school level?
opportunities	What are some of the opportunities that the pre-service teachers have with regard to developing their professional digital competency? What are the opportunities that they require for enhancing their PDC?	How important are the opportunities to enact their knowledge? How can the pre-service teachers really master their use towards innovation?
experiences	In your experience what are some of the most innovational teaching and learning experience?	In your opinion, what needs to be changed for the pre-service teachers to become competent with digital tools?
ProTed	What do you know about ProTed? Have you ever been engaged with any projects from ProTed?	What is the role of Centres of Excellence in your opinion? Do you think that the affiliated centres contribute towards the pre-service teachers, some how

Checklist

Main Points	Pilot	P.1	P.2	P.3	P.4	P.5	P.6	P.7	P.8
IT background									
Program type and year									
School level									
Major subjects									
Exaggeration									
Technology integration									
ICT subject didactics									
PDC Module									
Fieldwork									
Promo									
Video based									
Digital exam									
Flipped classroom									
LMS									
opportunities									
Experiences									
ProTed									

Information letter and Consent form

Are you interested in taking part in the research project?

Professional Digital Competency of Pre-service Teachers

A case study of Teacher Training Program at the University of Oslo, affiliated with the Centre of Excellence, ProTed.

This is an inquiry about participation in a research project where the main purpose is to explore the experiences of the pre-service teachers about developing their digital competency in Teacher Training Program. In this letter we will give you information about the purpose of the project and what your participation will involve.

Purpose of the project

This research project is part of the master`s degree in Higher Education at the University of Oslo (UiO), Department of Education. The central agenda of this project is to understand from the experiences of the pre-service teachers about developing their digital competency through their formal training programs. The projects also tend to investigate the role impact of the Centre of Excellence, ProTed in catering, understanding and introducing digital learning opportunities to prepare the pre-service teachers with the essential digital learning tools for learning and teaching.

In order to extract the living experiences of the pre-service teachers, I will conduct semistructured interviews to understand their perspectives on teaching and learning with digital tools. The main questions of this project comprise of understanding the experiences of preservice teachers in developing their competency. The data gathered from these interviews will be valuable for understanding and evaluating the perspectives of the pre-service teachers in developing their formal digital competency. The data collected will only be used for the purpose of this master´s thesis.

Who is responsible for the research project?

The University of Oslo is the institution responsible for the project.

Why are you being asked to participate?

You are invited to patriciate because you are currently enrolled at the Teacher Training Program at the University of Oslo (UiO). As the study seeks to extract the experiences of the pre-service teachers, thus you are an excellent candidate.

What does participation involve for you?

The participants involved in this research will be scheduled to meet at the same time at the university. The total time for the interview will be approximately 45- 60 minutes. The students will be asked questions about their experiences and perceptions of learning about digital tools and their level of competency in using them for teaching. The interview will be audio recorded in a digital recording software recommended by the UiO. The interview will be conducted in English and in a comfortable environment.

Participation is voluntary
Participation in the project is voluntary. If you chose to participate, you can withdraw your consent at any time without giving a reason. All information about you will then be made anonymous. There will be no negative consequences for you if you chose not to participate or later decide to withdraw.

Your personal privacy – how we will store and use your personal data
I will only use your personal data for the purpose specified in this information letter. I will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act) and the UiO´s data guidelines and procedures.

The data collected from the interviews will be stored on UiO´s server during the thesis and will be protected with a password. The data will be accessed by me and my supervisor. The data will be transcribed by me. I will replace the names with fictitious names so that the participants can be unrecognizable and no personal information will be referred to or published in the study. The data will be deleted at the end of the study.

What will happen to your personal data at the end of the research project? The project is scheduled to end on 30 December 2020. The personal data including the audio recording and the transcription will be deleted at the end of the project.

Your rights
So long as you can be identified in the collected data, you have the right to:

- access the personal data that is being processed about you
- request that your personal data is deleted
- request that incorrect personal data about you is corrected/rectified
- receive a copy of your personal data (data portability), and
- send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data

What gives us the right to process your personal data?
I will process your personal data based on your consent.

Based on an agreement with University of Oslo, NSD – The Norwegian Centre for Research Data AS has assessed that the processing of personal data in this project is in accordance with data protection legislation.

Where can I find out more?
If you have questions about the project, or want to exercise your rights, contact:

University of Oslo, Department of Education

Student:
Wardah Ahmad, by email: wardahah@student.uv.uio.no or by telephone: +4792545537

Supervisor:
Thomas de Lange, by email: t.de.lange@iped.uio.no or by telephone: +4722858558

NSD – The Norwegian Centre for Research Data AS, by email: (personverntjenester@nsd.no) or by telephone: +47 55 58 21 17.

Yours sincerely,

Student: Wardah Ahmad

Consent form

I have received and understood information about the project "Professional Digital Competency: A Case Study of Pre-service Teacher" and have been given the opportunity to ask questions. I give consent:

☐ to participate in an interview

I give consent for my personal data to be processed until the end date of the project, approx. 30th December, 2020.

(Signed by participant, date)