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Co-development of meaningful digital pedagogy

A qualitative multi-method study of teacher education practicums

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ABSTRACT

The main aim of the present dissertation is to extend the understanding of learning communities within the context of teacher education practicums and the co-development of meaningful digital pedagogy. As a result, and as a main contribution, this dissertation introduces a co-development process of meaningful digital pedagogy. This process aims to provide means for teacher educators, pre-service teachers, and in-service teachers involved in a practicum for mutual learning and collaborative practices to support their professional development. The research uses a qualitative multi-methods approach to answer the overarching research question: *How does the process of co-developing meaningful digital pedagogy unfold within the learning community context of a teacher education practicum?* The overarching research question was approached through three independent sub-studies with their own aims, research questions, data, and methods.

Sub-Study I was conducted as a systematic literature review to determine how the dimensions of digital pedagogy were conceptualized in the current research literature. Sub-Study I included a total of 12 empirical, peer-reviewed articles published between the years 2014 and 2018 as its research data. The aim was to conceptualize the dimensions and offer a model for digital pedagogy to provide tools for teachers to implement digital technologies in their teaching. Based on the results, a model for digital pedagogy was formed, which is discussed in terms of three dimensions: 1) pedagogical orientation, 2) pedagogical practices, and 3) the digital pedagogical competencies it requires of the teacher. Sub-Study II was conducted as a case study to identify which characteristics that define the concept of a Community of Practice (CoP) could be recognized in a teacher education practicum and how stakeholders perceived digital pedagogy in the context of practices for co-development. The

case study utilized data from two sources: instructional documents employed during a studied practicum and qualitative interview data from teacher educators (n=2), pre-service teachers (n=5), and mentor in-service teachers (n=6) involved in the practicum. The results of Sub-Study II revealed that the teacher education practicum reflected characteristics of a CoP, such as collaboratively *negotiated goals*, *addressing challenges*, *leveraging individual expertise*, and *regular and intentional interaction*. Additionally, the results revealed that digital technologies were not always used as part of teaching in a pedagogically meaningful way. As a result, Sub-Study III explored this topic further. Sub-Study III utilized a phenomenographic research approach, and its aim was to identify variations in the meanings attributed to collaborative practices and in the conceptualization of meaningful digital pedagogy during the teacher education practicum. The data of Sub-Study III was collected with qualitative group interviews from university teacher educators (n=4), pre-service teachers (n=8), and mentor in-service teachers (n=4) involved in the teacher education practicum. The results of Sub-Study III indicate that teacher education practicums could be seen as a context for *learning with and from each other*, *co-development*, or *collegial support*. Additionally, meaningful digital pedagogy was conceptualized as a *student-centered view*, *a future-oriented view,* or *a technology-focused view* of teaching.

The outcome of the study is a presentation of the co-development process of meaningful digital pedagogy. The presentation of the process is threefold: 1) establishing a learning community, 2) conceptualizing meaningful digital pedagogy, and 3) co-development of meaningful digital pedagogy. The first phase introduces an idea of how to implement a learning community approach in a teacher education practicum. The second phase focuses on conceptualizing a shared understanding of meaningful digital pedagogy. Finally, the third phase describes the practices involved in the co-development of meaningful digital pedagogy. The findings are valuable for both school and university personnel involved in organizing teacher education practicums. Additionally, other fields within universities that arrange practicum periods for their students may also find the presented ideas beneficial. Furthermore, the results can assist those interested in adopting a learning community approach for co-developmental activities. The dissertation builds on existing research on teacher education practicums, further emphasizing their role as a context for university-school collaboration. It proposes that teacher education practicums can foster collaboration between universities and the surrounding community, linking theoretical knowledge with practical application in a mutually beneficial learning process.

TIIVISTELMÄ

Janne Väätäjä
Mielekkään digipedagogiikan yhteiskehittäminen: Laadullinen monimenetelmä-
tutkimus opettajankoulutuksen harjoitteluissa
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Tämän väitöskirjan päätavoitteena on laajentaa oppiviin yhteisöihin liittyvää ym-
märrystä opettajankoulutuksen harjoitteluiden ja mielekkään digipedagogiikan
yhteiskehittämisen kontekstissa. Väitöskirjan pääasiallisena tuloksena kuvataan
prosessi mielekkään digipedagogiikan yhteiskehittämiselle. Prosessin tarkoituk-
sena on tarjota opettajankouluttajille, opettajaopiskelijoille ja työelämässä oleville
opettajille keinoja harjoittelun aikaiselle keskinäiselle oppimiselle sekä yhteistyö-
käytäntöjä tukemaan heidän ammatillista kehittymistään. Tutkimus on laadullinen
monimenetelmätutkimus, jonka tavoitteena on vastata päätutkimuskysymykseen:
*Miten mielekkään digipedagogiikan yhteiskehittämisprosessi muotoutuu opettajan-
koulutuksen harjoittelun oppivan yhteisön kontekstissa?* Päätutkimuskysymystä
lähestyttiin kolmen itsenäisen osatutkimuksen kautta, joilla oli omat tavoitteensa,
tutkimuskysymyksensä, aineistonsa ja menetelmänsä.

Osatutkimus I toteutettiin systemaattisena kirjallisuuskatsauksena, jossa selvitet-
tiin, miten digipedagogiikan ulottuvuudet on käsitteellistetty aiemmassa tutkimus-
kirjallisuudessa. Osatutkimuksen I tutkimusaineistona oli yhteensä 12 empiiristä,
vertaisarvioitua artikkelia, jotka oli julkaistu vuosina 2014–2018. Tavoitteena oli
käsitteellistää ulottuvuudet ja luoda malli digipedagogiikalle, joka tarjoaisi opet-
tajille välineitä digitaalisten teknologioiden hyödyntämiseen osana opetustaan.
Tulosten perusteella muodostettiin malli digipedagogiikalle, joka sisältää kolme
ulottuvuutta: 1) pedagoginen orientaatio; 2) pedagogiset käytännöt; ja 3) opet-
tajan tarvitsemat digipedagogiset kompetenssit. Osatutkimuksessa II toteutettiin
tapaustutkimuksena, jonka avulla selvitettiin, että mitkä käytäntöyhteisöä (CoP)
määrittävät piirteet voidaan tunnistaa opettajankoulutuksen harjoittelussa ja miten
osallistujat käsittivät digipedagogiikan yhteiskehittämisen käytäntöjen konteks-
tissa. Tapaustutkimuksessa käytettiin kahdenlaista tutkimusaineistoa: harjoittelua

ohjaavia asiakirjoja sekä harjoitteluun osallistuneilta opettajankouluttajilta (n=2), opettajaopiskelijoilta (n=5) ja työelämässä olevilta ohjaavilta opettajilta (n=6) kerättyä laadullista haastatteluaineistoa. Osatutkimuksen II tulokset paljastivat, että opettajankoulutuksen harjoittelujaksolla ilmeni käytäntöyhteisön piirteitä, kuten *yhteisesti neuvoteltuja tavoitteita, haasteiden käsittelyä, yksilön asiantuntemuksen hyödyntämistä* sekä *säännöllistä ja tarkoituksellista vuorovaikutusta*. Lisäksi tulokset paljastivat, että digitaalisia teknologioita ei aina käytetty opetuksessa pedagogisesti mielekkäällä tavalla. Tämä johti kolmanteen osatutkimukseen, jossa tutkittiin tätä aihetta tarkemmin. Osatutkimus III toteutettiin fenomenografisena tutkimuksena, ja sen tavoitteena oli tunnistaa variaatioita yhteistyökäytännöille annetuissa merkityksissä sekä mielekkään digipedagogiikan käsitteellistämisessä opettajankoulutuksen harjoittelun aikana. Osatutkimuksen III aineisto kerättiin laadullisilla ryhmähaastatteluilla opettajankoulutuksen harjoitteluun osallistuneilta yliopiston opettajankouluttajilta (n=4), opettajaopiskelijoilta (n=8) ja työelämässä olevilta ohjaavilta opettajilta (n=4). Osatutkimuksen III tulokset osoittavat, että opettajankoulutuksen harjoittelujaksoja voidaan pitää *yhdessä ja toisilta oppimisen*, *yhteiskehittämisen* tai *kollegiaalisen tuen* kontekstina. Lisäksi mielekäs digipedagogiikka käsitteellistettiin *opiskelijakeskeisenä*, *tulevaisuuteen suuntautuneena* tai *teknologiakeskeisenä* näkemyksenä opetukseen.

Tutkimuksen päätuloksena esitetään tarkoituksenmukaisen digipedagogiikan yhteiskehittämisen prosessi. Prosessin esitys on kolmiosainen: 1) oppivan yhteisön perustaminen, 2) mielekkään digipedagogiikan käsitteellistäminen, ja 3) mielekkään digipedagogiikan yhteiskehittäminen. Ensimmäinen osa esittelee idean oppivaan yhteisöön liittyvän lähestymistavan toteuttamisesta osana opettajankoulutuksen harjoittelua. Toinen osa käsittelee mielekkään digipedagogiikan käsitteellistämistä tulosten perusteella. Lopuksi kolmas osa kuvaa käytäntöjä, jotka liittyvät mielekkään digipedagogiikan yhteiskehittämisen prosessiin. Tulokset ovat hyödyllisiä sekä koulujen että yliopistojen henkilöstölle, jotka osallistuvat opettajankoulutuksen harjoittelujen järjestämiseen. Lisäksi myös muut opiskelijoilleen harjoitteluita järjestävät yliopistojen koulutusohjelmat voivat hyötyä tutkimuksen tuloksista. Tulokset voivat myös auttaa niitä, jotka ovat kiinnostuneita soveltamaan oppivan yhteisön lähestymistapaa osana yhteiskehittämistä. Väitöskirja pohjautuu olemassa olevaan tutkimukseen opettajankoulutuksen harjoitteluista ja korostaa niiden roolia yliopiston ja koulun välisenä yhteistyöympäristönä. Opetusharjoittelut voivat edistää yhteistyötä yliopistojen ja ympäröivän yhteiskunnan välillä, yhdistäen teoreettisen tiedon käytännön sovelluksiin molempia osapuolia hyödyttävässä oppimisprosessissa.

Avainsanat: luokanopettajakoulutuksen opetusharjoittelu, käytäntöyhteisö, oppiva yhteisö, yhteiskehittäminen, mielekäs digipedagogiikka

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I need to acknowledge the support of my dear mom and dad – kiitos äiti ja isä, kun olette jaksaneet tukea minua koko elämäni ajan ja kuunnella höpötyksiäni tästä väitöstutkimuksesta. Also, thanks to my dear little sister Meiju for all the encouragement. The deepest appreciation goes to my beloved and beautiful wife Malla who has been my support during the whole process. She has taken my mind off the dissertation process when needed and put my mind back in when necessary. Malla's love, laughter, and presence have kept me grounded, reminding me that life is more than work and words on a page. Without Malla, I am sure I would not have any hair left on my head by the time I finished my dissertation. Thanks to her I still have some. Lastly and leastly, I must thank our cats, Kisse-Kisserton and Papu Papunen, for enduring a dramatic change in my music taste and witnessing many curse words—whether out of frustration or relief— without tattling about it to anyone.

LIST OF ORIGINAL ARTICLES

The present dissertation is based on the following three articles, which are hereafter referred to as Sub-Studies I, II, and III:

Sub-Study I
Väätäjä, J., & Ruokamo, H. (2021). Conceptualizing Dimensions and a Model for Digital Pedagogy. *Journal of Pacific Rim Psychology, 15*. https://doi.org/10.1177/1834490921995395

Sub-Study II
Väätäjä, J. (2023). A Community of Practice Approach to the Co-Development of Digital Pedagogy: A Case Study of Primary School Teacher Education Practicum. *European Journal of Teacher Education,* 1–18. https://doi.org/10.1080/02619768.2023.2198102

Sub-Study III
Väätäjä, J., & Korte, S-M., (2023). Exploring the conceptions of meaningful digital pedagogy in the context of teacher education practicums. *Education in the North*, *30*(2), 136–155. https://doi.org/10.26203/4fyb-yy18

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1   INTRODUCTION

1.1 Background

Over the past decade, there has been a significant rise in both interest and necessity for the integration of digital technologies within Finnish primary and lower secondary education (basic education). As per the Finnish National Core Curriculum for Basic Education 2014, adopted by schools in their own implementation plans in August 2016, skills related to digital technology have been incorporated into the curriculum as an integral part of transversal competencies (Finnish National Board of Education, 2016). The national core curriculum serves as both a legal and pedagogical foundation for municipalities and educational institutions (Vahtivuori-Hänninen et al., 2014). The curriculum further emphasizes that practicing teachers require both technological and pedagogical expertise to implement various digital technologies tailored to their specific needs effectively. Simultaneously, they must also comprehend the implications of their choices (Tanhua-Piiroinen et al., 2019; Huhtala & Vesalainen, 2017.)

Various types of learning communities have been implemented in both school and university settings as a form of support for professional development (Admiraal et al., 2021; Akiba & Liang, 2016; Doğan & Adams, 2018; Katz & Earl, 2010; Stoll et al., 2006; Vescio et al., 2008; Voelkel & Chrispeels, 2017). The aim of these learning communities is to support their members' collaboration to enhance teaching methods, student learning, and organizational structure (Sadik, 2010). This dissertation utilizes a learning community approach to the co-development of meaningful digital pedagogy within the context of teacher education practicums involving teacher educators, pre-service teachers, and in-service teachers. The main aim of the present dissertation is to extend the understanding of learning communities within the context of teacher education practicums and the co-development of meaningful digital pedagogy. As a result, and as a main contribution, this dissertation introduces a co-development process of meaningful digital pedagogy. The present study also provides an understanding of how the learning community approach can be implemented in a practicum and what it requires from the actors involved in it. The dissertation is aimed specifically toward teacher educators and in-service teachers involved in teacher education practicum because it may provide tools for developing teacher education practicums as university courses and as contexts for collaboration. The presented process can be used to build strategies for implementing learning communities in other educational contexts in the future as well.

Digital pedagogy has been introduced in the topical research literature as an approach to teaching that utilizes digital technologies (Sailin & Mahmor, 2018; Croxal, 2012; Kivunja, 2013). However, digital pedagogy lacks a detailed conceptualization, and the definitions vary depending on the research context. This raises the need to investigate what makes digital pedagogy meaningful. Other scholars have made further conceptualizations about digital pedagogy which promote social constructivist and learner-centered approaches to learning (Montebello, 2017; Wadmany & Kliachko, 2014). These two highlight the learner's active role and social knowledge construction in learning (Dewey, 1938; Vygotsky, 1978). Recent theoretical frameworks, such as Technological Pedagogical Content Knowledge (TPACK) by Mishra and Koehler (2006) and the Technology Integration Matrix (TIM) by Harmes, Welsh, and Winkelman (2016), have different areas of focus—still related to technology integration. While both aim to guide technology integration in education, TPACK focuses on the intersection of content, pedagogy, technology, and context, whereas TIM focuses on describing and targeting the use of technology to enhance learning (Harmes et al., 2016; Mishra, 2019; Mishra & Koehler, 2006). It is noteworthy that technology integration frameworks are helpful tools for teachers' professional development. The success of using these frameworks also depends on other factors, such as teachers' readiness and the support they receive (Gondwe, 2021).

The present study is topical as the COVID-19 pandemic caused a rapid shift globally from contact to distance teaching. In-service teachers needed to find new tools and ways to arrange teaching. Consequently, this trend has extended to teacher education programs, emphasizing the meaningful integration of these technologies to enhance teaching practices and learning processes (Kimav & Aydin, 2020; Lähdesmäki & Valli, 2018; Nehring et al., 2019). Modern educators are required to reassess pre-existing teaching strategies and explore how to blend curriculum, technology, community engagement, and learning practices in ways that enhance student motivation, self-regulation, and retention in online learning environments (Fisher & Baird, 2005; Lähdesmäki & Valli, 2018). The COVID-19 pandemic revealed that the need for distance teaching may arise unexpectedly and pressure teachers to quickly adapt to changing circumstances and possibly implement new digital technologies and teaching methods. These preparations and teaching arrangements during the COVID-19 pandemic caused radical changes in educational institutions of all levels and forced education experts to think about teaching and learning processes from new standpoints (OECD, 2023). We are unlikely to return to completely old ways of doing things, but hybrid arrangements for teaching will be commonplace in the future (Devlin & Samarawickrema, 2022). Therefore, it is important to identify effective teaching methods and digital technologies discovered during the time of distance teaching to be further developed. However, it is noteworthy that integrating new digital technologies in

teaching should not be automatically considered to enhance the learning process. Saarinen (2020) points out that self-directed learning practices and the frequent use of digital learning materials may be linked to weaker learning outcomes for students at 15 years of age. Hienonen et al. (2024), however state that the use of digital technologies and weaker leaning outcomes should not be interpreted as a causal relationship. Therefore, it would be beneficial to provide support for teachers in integrating digital technologies as part of their teaching in a meaningful way (Iivari et al., 2020; Kaminskienė et al., 2022).

In today's digital world, technological competence is essential, whether for professional pursuits or active, responsible participation in society (Salomaa & Palsa, 2019). This raises pertinent questions about how digital technologies and digital pedagogy are addressed within teacher education and whether pre-service teachers receive sufficient skills for their future careers. Cuban (2018) notes that the same challenge is faced by teacher educators at universities and by in-service teachers working in schools. There may be situations where digital technologies are not fully utilized in basic education, which may lead to their limited emphasis in teacher education programs. Conversely, an insufficient focus on digital pedagogy in teacher education may result in its ineffective implementation in basic education. This is not a universal situation and can vary based on different factors such as resources, training, and institutional priorities (Cuban, 2018). Furthermore, Fernández-Bataner et al. (2022) identified teacher collaboration and the strategic use of technological tools as recurring themes in professional development for educators. Therefore, it would be beneficial to implement practical training programs that not only equip teachers with the necessary skills but also foster a collaborative environment.

The Finnish Teacher Education Forum[1] (2023) suggests that higher education institutions involved in teacher education could consider implementing curricula that encompass multidisciplinary, authentic, and innovative learning and development tasks for pre-service teachers, fostering societal interaction. It would be beneficial if teacher education could also be arranged in such a way that it involves both pre-service teachers and those already working in the profession (Finnish Teacher Education Forum, 2023). Teacher education programs arrange this kind of collaboration in different ways. In Finland, teacher education practicums are part of teacher education programs, which are expected to collaborate and interact with the surrounding society and organizations such as schools (Maaranen &

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1   The Teacher Education Forum was established by the Ministry of Education and Culture. The forum includes all higher education institutions that offer teacher education and the relevant stakeholders. The mission of the Teacher Education Forum has been to create a development program for teacher education to reform pre-service, introductory and in-service teacher education and training for teachers, promote the implementation of the development program, support teacher education development projects, and address current issues concerning teacher education and research related to teachers and teacher education.

Stenberg, 2021). In some studies (Resch et al., 2022; Kyllönen, 2020), teacher education practicums are one context where collaboration between actors from different organizations is possible. During practicums, the involved actors have the opportunity to develop their skills and knowledge as educators through practical experience in the classroom. This can involve trying out new teaching strategies and techniques, reflecting on their teaching practice, and receiving feedback from each other (Tiainen et al., 2018). Simultaneously, a practicum offers the participants a chance to combine their theoretical knowledge with their teaching practice. This can involve collecting and analyzing data on student learning outcomes, examining the effectiveness of different instructional methods, and exploring the impact of contextual factors on teaching and learning (Heikonen et al., 2017).

There has been limited research on teacher education practicums as learning community environments that involve the collaboration of university teacher educators, pre-service teachers, and in-service teachers in co-development. Specifically, more research is needed to explore the significance of these collaborative environments in the co-development of meaningful digital pedagogy. This dissertation aims to fill this gap by examining the co-development of meaningful digital pedagogy in the context of teacher education practicums, and it consists of one theoretical (Sub-Study I) and two empirical (Sub-Studies II and III) sub-studies. This dissertation combines the examination of the learning community approach in teacher education practicums and the co-development of meaningful digital pedagogy. The specific aims of the study are:

1. to develop a process for implementing a learning community approach in a teacher education practicum (Sub-Studies II & III).
2. to conceptualize meaningful digital pedagogy (Sub-Studies I, II & III),
3. to develop practices for the co-development of meaningful digital pedagogy (Sub-Studies II & III),

The first aim seeks to develop a process for implementing a learning community approach into teacher education practicums. A learning community approach is used to foster co-development and learning, which can be particularly beneficial in a practicum. The process is informed by the results of Sub-Studies II and III. The second aim focuses on deepening the comprehension of meaningful digital pedagogy through the following dimensions: orientation, practices, and competencies. The insights from Sub-Studies I, II, and III contribute to this understanding. The third aim is to create practices that enable the co-development of meaningful digital pedagogy. This emphasizes the importance of collective efforts to enhance digital pedagogy, involving teacher educators, pre-service teachers, and in-service teachers. The findings from Sub-Studies II and III offer valuable inputs for this co-development process.

The empirical sub-studies (II & III) were carried out in a university setting in the context of teacher education practicums, which are part of the Teacher Education Curriculum of the University of Lapland. It is noteworthy that teacher education is strongly regulated and has long traditions. Thus, the development of practicums require commitment from the leaders of teacher education. Furthermore, this dissertation acknowledges the role of the basic education field that partners with universities and offers practicum places. The participants in sub-studies II and III were teacher educators, pre-service teachers, and mentor in-service teachers. The teacher education practicums provided a suitable context for conducting this research because they are one way of carrying out a partnership between universities and schools, as they engage teacher educators, pre-service teachers and mentor in-service teachers to work together in real-life situations. The implementation of the learning community approach within teacher education practicums offers a new way of researching and carrying out university-school collaboration.

1.2   The process of the study

The research process began at the beginning of the year 2019, just before the Covid-19 pandemic started to affect our everyday lives. Sub-studies I and II were conducted during the time the educational institutions had to prepare and provide practical solutions to arrange teaching while in consideration of the restrictions created to tackle the pandemic. Sub-Study III was conducted after the Covid-19 pandemic related restrictions in the year 2023. Figure 1 represents the research process.
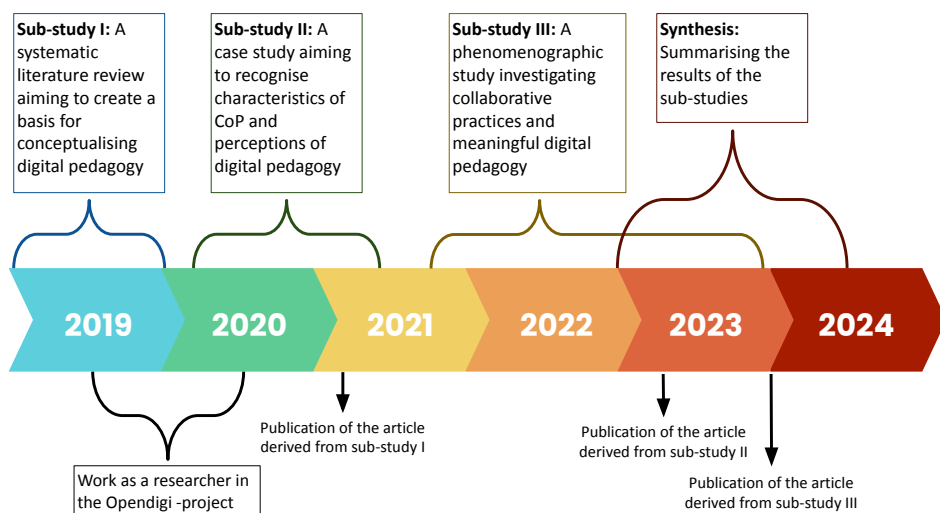
Figure 1 Research process

Sub-Study I was conducted as a systematic literature review in February 2019 because there did not seem to be a clear definition for the concept of digital pedagogy. Thus, Sub-Study I aimed to create a basis for conceptualizing the dimensions and a model of digital pedagogy. The findings provided a foundation for Sub-Study II. This work proceeded in Sub-Study II by recognizing the characteristics of a Community of Practice (CoP) in the teacher education practicum and the pre-service teachers', in-service teachers', and university teacher educators' perceptions of digital pedagogy. This study provided a view of how university-school collaboration can be arranged through teaching practicums so that all the actors involved have the potential to co-develop digital pedagogy and learn from each other. Sub-Study II was conducted in collaboration with the Opendigi -project[2] (2017–2020) which was funded by the Finnish Ministry of Education and Culture. The Opendigi project was coordinated by the University of Oulu, and other partners included the University of Lapland, the University of Jyväskylä, the University of Eastern Finland, and the University of Turku. The project aimed to enhance pre-service teachers', in-service teachers', and university teacher educators' expertise in digital pedagogy and the development of learning skills by integrating the research-based expertise of teacher education institutions with the developmental work of basic education schools. The results of Sub-Study II raised the need for a more in-depth investigation of the teacher education practicum as a context for the co-development of meaningful digital pedagogy to be continued in Sub-Study III. Sub-Study III utilized a phenomenographic research approach in order to investigate collaborative practices and meaningful digital pedagogy in the context of teacher education practicums.

I worked during the sub-studies with other researchers, and some of them were second authors in the articles that were published based on the sub-studies. All of the articles derived from Sub-Studies I–III have been published in open access in peer-reviewed international scientific journals. Table 1 describes the contributions of the authors to the articles derived from Sub-Studies I–III.

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2   The OpenDigi -project: Opendigi – Teachers' communities for improving learning and digipedagogi-cal skills (2017–2020), funded by the Finnish Ministry of Education and Culture (OKM/62/523/2017).

Table 1 Description of the authors' contributions in each sub-study

	Väätäjä's contribution	**Other authors' contributions**
Sub-Study I	• collected and analyzed the data • interpreted the results • wrote and finalized the article • revised the article based on the received reviews	The second author contributed to the interpretation of the results and provided guidance for the revision of the theoretical framework
Sub-Study II	• collected and analyzed the data • interpreted the results • wrote and finalized the article • revised the article based on the received reviews	No other authors
Sub-Study III	• collected and analyzed the data • interpreted the results • wrote most of the manuscript • finalized the article • revised the article based on the reviews received	The second author contributed to the interpretation of the results through phenomenographic analysis and provided guidance for forming the *discussion and conclusion* section

I was working throughout the research process during each of the sub-studies, and none of the phases related to them were handed out to any other author to complete on their own. It is important to note that the guidelines for authorship provided by the Finnish National Board on Research Integrity TENK (2019), were followed when agreeing on co-authorship. The other authors' roles were related mostly to helping me interpret the results. In Sub-Study I, the second author's role was emphasized in interpreting the results and guidance in constructing the theoretical framework. In Sub-Study III, I was supported by the second author, especially concerning interpreting the results and providing guidance on forming the discussion and conclusion sections.

1.3   Context of the study

This study focuses on education for class teachers, where teachers are trained to work in primary and lower secondary education (basic education). Basic education in Finland lasts nine years, covering ages 7 to 16. In Finland, class teacher education is organized by universities. All class teachers are required to complete a five-year, research-intensive master's degree in a university to obtain formal class teacher qualifications. Qualification requirements for teachers are specified in the Decree on Qualification Requirements for Teaching Staff (986/1998). The programs are

conducted by academic teacher educators who not only teach but are also active researchers in the field of teacher education (Toom & Husu, 2021).

In the context of this study, at the University of Lapland, pre-service teachers follow a teacher education curriculum consisting of courses related to theory, methodology, pedagogy, and didactics. The aim of the teacher education program at the University of Lapland is to help pre-service teachers construct their teacher identities, acquire the skills necessary for continuous professional growth, and educate them as experts in pedagogy and didactics. Additionally, the curriculum includes five practicum periods, one per year, which the pre-service teachers complete over the course of their five-year program to become fully qualified class teachers. Each of the five practicum periods has its own focus areas. The first four of the five practicum periods are completed in the teacher training school, and for the last practicum, the pre-service teachers are permitted to choose the school where to complete the period.

Teacher training schools are administratively part of the faculties of education in Finland and apart from providing teaching for comprehensive and upper secondary levels, teacher training schools have other duties as well. Other duties are focused on supervision and tutoring of pre-service teachers, teaching experiments, and research and provision of in-service education (FTTS—Finnish Teacher Training Schools, 2022), thus making the Teacher Training School of the University of Lapland suitable for implementing the learning community approach for the co-development of meaningful digital pedagogy. Through this effort, it has sought to collect information for a more detailed and structured approach to the co-development of meaningful digital pedagogy. In the present research, pre-service teachers, mentor in-service teachers, and university teacher educators were involved in the production of knowledge about collaborative practices and meaningful digital pedagogy in the context of a teacher education practicum. In Finnish teacher education the role of both teacher training schools and field schools which are not a part of the universities have been studied. Some researchers (Jyrhämä & Syrjäläinen, 2009; Syrjäläinen & Jyrhämä, 2013) argue that expanding practicums to other types of environments than teacher training schools would open new opportunities for interaction between teacher education and society and in this respect would support the societal mission of teacher education. One reason for this is the concept of situated learning by Lave and Wenger (1990), who examined learning in authentic work environments. From the perspective of skills development, it is detrimental if learning is decontextualized, in other words, detached from the context or environment in which it should be applied (Lave & Wenger, 1990). New teachers report that there are significant differences related to the physical environment between training schools and field schools (Heikkinen, et al., 2014). Jokinen and Välijärvi (2006) found out that these differences manifest, for example, in the size of teaching groups, teaching tools, and financial resources.

It is noteworthy that teacher education curriculums are developed regularly in Finnish universities. At the University of Lapland Faculty of Education, the curricula are made for approximately three-year periods at the time. This study primarily concentrates on two practicums: the guided advanced practicum part of the curriculum 2021–2024 and the guided field practicum part of the curriculum 2018–2021. These practicums are undertaken during the final two years of teacher training.

Because the area of interest in this research focuses on real-world settings in teacher education practicums and university teacher educators', pre-service teachers', and mentor in-service teachers' views, the social constructivist paradigm has guided the work. A research paradigm may be defined as "the set of common beliefs and agreements shared between scientists about how problems should be understood and addressed" (Kuhn, 1992, p. 43). The social constructivist paradigm emphasizes the significance of social contexts and interactions in the construction of knowledge and reality. It posits that our understanding of the world is shaped through social processes and shared experiences rather than existing as an objective entity to be discovered. (Vygotsky, 1978.) Table 2 presents the summarization of the focus areas of the guided field practicum and guided advanced practicum.

Table 2 Focus areas of the University of Lapland's guided advanced practicum and guided field practicum

Guided Advanced Practicum (7 ECTS) • **Curriculum 2021–2024** • **Sub-Study III**	• Completed in the teacher training school of the University of Lapland during their fourth year of studies • Responsibility for the overall welfare of their pupils, fostering a sense of community within the classroom, and maintaining an effective learning environment • Interactive engagement in an expert community to promote the students' learning and growth • Research-based approach to professional development and wellbeing
Guided Field Practicum (5 ECTS) • **Curriculum 2018–2021** • **Sub-Study II**	• Completed in a school of the pre-service teacher's' own choosing during their last and fifth year of studies • Collaborative teaching with mentor in-service teachers • Planning of work in regard the school's curriculum and organizational development strategies • Research-based approach to school development

The context for Sub-Study III was the Guided Advanced Practicum, which is the fourth practicum completed in the Teacher Training School of the University of Lapland by pre-service teachers during the fourth year of their studies. The Guided Advanced Practicum is focused on the direct interaction and individualization of learning processes. It is more oriented towards detailed weekly and daily planning and the practical aspects of teaching, including creating learning environments and selecting teaching methods that consider equality and diversity. It also emphasizes experimental and research-based approaches to teaching and professional growth. The Guided Advanced Practicum was chosen as a context because, at this point, the pre-service teachers already have experience with the other practicums and of planning, executing, and evaluating the learning process. The Guided Advanced Practicum provided a context for a more controlled examination because it starts at the same time for pre-service teachers, and it made it possible to gather a group interested in taking part in the research.

The Guided Field Practicum was the context of Sub-Study II. Pre-service teachers are permitted to choose the school (other than University Teacher Training School) in which they wish to complete it. The Guided Field Practicum is the fifth and last of the practicums that the pre-service teachers complete during the last year of their studies. All of the other practicums are completed in the Teacher Training School of the University of Lapland. The Guided Field Practicum was chosen as a context from the other practicums because the pre-service teachers are placed in ordinary schools that are not part of the University of Lapland. The Guided Field Practicum emphasizes collaborative teaching, sharing pedagogical expertise, and reflective dialogue within the teaching community. It emphasizes a comprehensive approach to managing the learning and teaching process that includes planning, execution, and evaluation but also considers the local environmental opportunities in the specific school. Collaboration between the university as a place for research and schools as a place for institutionalized learning can provide a context for mutual learning (Resch et al., 2022; Kyllönen, 2020), thus making it beneficial to investigate practical solutions on how to carry out this partnership.

2   KEY CONCEPTS AND THEORETICAL FRAMEWORK

2.1 Learning communities and co-development

Social learning theorists (Bandura, 1977b; Cobb, 1994; Cobb & Yackel, 1996) suggest that communities provide a context for learning and constructing knowledge. Bandura's (1977b) social learning theory emphasizes that people learn in social contexts through observation, imitation, and modeling of others' behaviors. Social constructivist approaches, on the other hand, emphasize that learning is co-constructed through social interaction, where both the individual and community contribute to the process (Cobb, 1994; Cobb & Yackel, 1996). Therefore, communities can provide individuals with a safe environment to participate in mutual knowledge construction through observation and interaction with other people. In educational contexts, learning communities are used as a concept to discuss social relationships and roles of teachers and learners—in this case, the roles of university teacher educators, pre-service teachers, and in-service teachers. In such communities, teachers are encouraged to openly acknowledge both their knowledge and areas of uncertainty with the other members of the community. This shift towards equalizing the roles of teacher educators, pre-service teachers, and in-service teachers typically enhances participation across the board, though it may also introduce feelings of discomfort and insecurity (Botha & Nel, 2022; Graves, 1992). Kahila et al. (2023) emphasize the role of collaborative relationships within practicum environments, suggesting that the practicum work community—which includes not just mentor in-service teachers but the entire school environment— helps pre-service teachers learn by fostering participation, confidence-building, and agency. The learning community is established in the teacher education practicum. However, merely establishing a learning community does not guarantee that it will work as one. Edmondson and Harvey (2018) argue that the mere presence of knowledge diversity within a team does not inherently lead to improved performance. Instead, it is when this diverse knowledge is activated through interaction in the face of a creative task or challenge that it becomes a beneficial asset to the team (Edmondson & Harvey, 2018).

It is worth mentioning that various types of learning communities, such as professional and faculty learning communities, have already been conceptualized and implemented across educational settings, ranging from early childhood education to the university level. The concept depends mostly on the context of the community. The Professional Learning Community (PLC) has been used as a concept usually in

the context of K-12, and the focus is to provide means for teachers to learn, share, and encourage each other to develop and test new pedagogies (Stoll et al., 2006). Eyanagho (2019) states that PLCs in school contexts have the potential to create a lifelong learning environment for both experienced and new teachers to navigate annual challenges together. These challenges include changes in education laws, school procedures, curriculum content, new teaching materials and techniques, technology integration, student demographics, and evolving learning needs (Eyanagho, 2019). Professional development can occur informally within PLCs through discussions, peer observations, and shared learning experiences (Kahila et al., 2023). A Faculty Learning Community (FLC), on the other hand, is more focused on facilitating learning among its members within a faculty of a university (Tinnell, Ralston, Tretter, & Mills 2019). PLCs and FLCs are both examples of communities in which the members share a common interest and practice, known as communities of practice (Lave & Wenger, 1991). A learning community is used as a term here in this study because it involves actors from both the school and the university faculty contexts.

The learning community implementations have in common that they are used as an approach even though they are in different settings to bring people together to share knowledge and collaborate in a growth-promoting way (Admiraal et al., 2021; Akiba & Liang, 2016; Doğan & Adams, 2018; Katz & Earl, 2010; Stoll et al., 2006; Vescio et al., 2008; Voelkel & Chrispeels, 2017). Several studies implementing the idea of a learning community, do not describe in detail the practical actions required by the members in order to work as a learning community (Lomos et al., 2011). However, Kilpatrick et al. (2003) identified two distinct focus areas for learning communities. The first focus area emphasizes the human aspect of communities, highlighting the benefits that arise from leveraging the knowledge of people in the same location or with shared interests. This approach focuses on individuals collaborating to exchange understandings, skills, and knowledge toward common goals. The second focus area relates to curriculum structures, where the learning community refers to an organizational structure aimed at enhancing learning of pre-determined curriculum content (Kilpatrick et al., 2003).

A Community of Practice (CoP) was chosen to theorize and provide structure for collaboration in the learning community established in the teacher education practicum. Sadik (2021) found that CoP can be an effective model also within the context of teacher education when all the members exchange ideas in a supportive environment. CoP provided a suitable approach because it describes the practices in detail that can support collaboration, especially in a situation where participants are working in different organizations, as in this case in basic education and in a university. According to the recent conceptualization of CoP, as a tool it will be the most effective when it includes the following three elements: 1) domain, 2) community, and 3) practice (Wenger, 1998; Wenger et al., 2002; Wenger-Trayner & Wenger-Trayner, 2015).

The domain is the shared area of interest among the individuals belonging to the CoP. The domain of interest is considered among the members of the community as a collective competence that can be enhanced in collaboration. To enhance or develop their collective competence, the members must negotiate common goals and address challenges concerning their domain of interest. (Wenger-Trayner & Wenger-Trayner, 2015; Wenger, 1998.) In this study the shared domains of interests are related to developing meaningful digital pedagogy in the context of basic education. Thus, the domains of interests are shaped by the curriculum, the actors' own competencies and the learning objectives set for themselves. Additionally, both the university's and school's missions and vision affect the domains of interests (Vangrieken et al., 2017). However, this should not be viewed as a problem, but rather as an opportunity, because identifying shared goals can benefit both institutions (Jyrhämä & Syrjäläinen, 2009; Syrjäläinen & Jyrhämä, 2013). It is also important to provide autonomy for the members of the community to set their own goals. Mindich and Lieberman (2012) remind us that if there is too much autonomy and the members struggle to identify their goals and plan their activities, it may lead to frustration or cause anxiety. Thus, it is beneficial to have someone who can step in and provide directions (Mindich & Lieberman, 2012).

A community refers to the joint activities, discussions and sharing of information related to a shared domain of interest (Wenger-Trayner & Wenger-Trayner, 2015; Wenger, 1998). In this study, the community consists of university teacher educators, pre-service teachers and in-service teachers who are involved in the teacher education practicums. The community members in this case are working or studying in two different organizations—a university and a school. Therefore, it would be beneficial for the school leadership to facilitate the connection between schools and the changing external environment, helping them adapt and remain relevant (Pont, et al., 2008). However, this effort should not be shouldered by the schools alone but should also involve the leadership from university teacher education programs. Warner and Hallman (2017) argue that teacher education practicums can provide a context for teacher educators, pre-service teachers and in-service teachers to contribute by bringing forward real-world teaching challenges they encounter. Furthermore, within the practicum, they could create solutions to these challenges and implement them in practice (Warner & Hallman, 2017). Moreover, it is beneficial to highlight that pre-service teachers, in-service teachers, and university educators should actively engage with one another to become a community that collaboratively develops their teaching practices.

Practice is comprised of a shared repertoire of resources, such as experiences and ways of addressing recurring problems (Wenger-Trayner & Wenger-Trayner, 2015; Wenger, 1998). Furthermore, in the 1990s Schrage (1990) already highlighted the importance of being ready to contribute in a time characterized by significant specialization across various fields of human activity caused by swift technological

advancements. This trend towards specialization challenges specialists to grasp the overall big picture. Therefore, collaboration between specialists becomes crucial (Hakkarainen, 2021). Teacher education practicums provide some instructions and ways for pre-service teachers to contribute to the school community during the practicum periods, but they mostly concentrate on the learning objectives of the pre-service teacher. It is noteworthy that the university course descriptions in Finland are guided by the National Qualifications Framework, meaning that course descriptions must clearly define the knowledge, skills, and competencies students are expected to acquire. This challenges the main idea of CoP: working together as equals toward a common goal (Li et al., 2009; Kling & Coutright, 2004). Mertler (2018) highlighted that professional learning communities present an effective alternative for achieving school improvement at the local level towards initiatives that have received national and international focus.

The CoP framework has many interpretations (cf. Engeström, 2007; Li et al., 2009; Tinnell et al., 2019), which can make it challenging for people working in different organizations to apply. Establishing a CoP is complex because it involves diverse human interactions, motivations, and dynamics. While the theoretical framework might be sound, the practical implementation can be challenging due to differing individual goals, communication styles, and levels of engagement (Li et al., 2009; Tinnell et al., 2019). To begin the implementation of CoP in an organization, it is crucial to build a consensus on the aim of the CoP and who the members are. Without building this consensus, it is difficult to evaluate the effectiveness of a CoP group. It is also noteworthy that there exists no universally optimal CoP design. Instead, CoP structures are tailored to facilitate active engagement between community members and to effectively address the specific goals and objectives of the community in question (Iaquinto et al., 2011). CoP implementations have also been used in a way that organizational boundaries are crossed, but not very often within educational contexts. However, Tytler et al. (2017) provide one example of CoP implementation where it is utilized between schools and community organizations, contributing to and enriching school science programs. They argue that curriculum can be viewed as a boundary phenomenon that can serve either as a resource or a point of resistance. This depends on whether the curriculum process or artifact is collaboratively understood and embraced by both the school and community organizations (Tytler et al., 2017). In this study the organizational boundaries are also crossed as it involves actors both from school and university.

The CoP framework provides a foundation for the learning community approach implemented in this dissertation, and it is examined in Sub-Study II. Based on Sub-Studies II and III, a new implementation of the practices for co-development was made and named the community consisting of the participants as the learning community. While both learning communities and CoPs involve groups of individuals who come together to learn and share knowledge, there are

some differences between the two concepts. A learning community is a broader concept that refers to a group of people who come together to share knowledge and learn from each other. Learning communities may include both formal learning opportunities, such as workshops and courses, as well as informal knowledge-sharing activities. The emphasis in learning communities is on creating an environment that supports learning, and this can extend beyond a specific professional domain (Akiba & Liang, 2016; Doğan & Adams, 2018; Stoll et al., 2006.) On the other hand, a CoP is often emphasized as a group of individuals who come together to share a common profession, craft, or field of interest. Unlike learning communities, CoPs are often characterized by members who actively engage in discussions, share experiences, and collectively develop expertise in a specific area. They also typically form around a shared practice or field of work and can exist in various settings, such as workplaces or professional associations. (Wenger-Trayner & Wenger-Trayner, 2015; Wenger, 1998.) In summary, while a CoP is a specific type of learning community with a focus on a particular professional or knowledge domain, a learning community is a more general term that encompasses a broader range of learning-oriented groups and settings. Thus, we are not talking about completely different concepts when comparing a learning community and a CoP. The main reason for choosing learning community as a term was done because the approach was structured so closely to the context of teacher education practicum—providing detailed practices and steps for the co-development, which are not described in detail in the original framework of CoP (cf. Wenger, 1998). Another reason for choosing the learning community as a term is that it involves university students. The practicum must function as a university course, which the students must complete to become qualified teachers.

The learning community approach can be contextualized in teacher education practicums but there is a need to understand that practicums are courses, part of teacher education curriculums with long traditions related to university teacher educators', pre-service teachers' and in-service teacher mentors' roles which may be in contradiction with the ideas of a learning community (Resch et al., 2022). It is also noteworthy that these existing roles may challenge equal involvement. For example, pre-service teachers may feel hesitant to fully contribute to the community if they perceive themselves as lacking authority or expertise. However, as Heikkinen et al. (2012) note, that while pre-service teachers may lack the same depth of experience as in-service teachers, recognizing epistemological equality ensures that their diverse knowledge and perspectives are equally valuable. A learning community may work as one when various forms of expertise are shared, regardless of rank or experience. Existential equality means that all participants, as human beings, deserve respect and a voice, while juridical equality means that all participants are treated equally under the law (Korhonen et al., 2017).

In this approach, teacher education practicums provide a context for the learning community, bringing together university teacher educators, pre-service teachers,

and in-service teachers to work together towards common goals. The learning community provides a supportive environment for teacher educators, pre-service teachers, and in-service teacher mentors to learn from each other regarding the planning, implementing, and evaluating of pedagogical solutions and to receive feedback on their own teaching. Elvira et al. (2017) identified three key learning processes that contribute to the growth of professional expertise among university students: 1) conversion of theoretical knowledge into practical application, 2) articulation of practical experiences into theoretical understanding, and 3) practice of self-regulation skills, such as evaluation, to reflect on both theoretical and practical knowledge. During practicums, theoretical knowledge from the university can be integrated with the practical task of improving existing school practices, which can potentially enhance the development of the students' professional expertise (Elvira et al., 2017). In this dissertation, the term learning community is used to describe the implementation, while CoP provides the theoretical foundation for its structure. Although learning community was chosen as the primary term, defining and examining CoP is still necessary to clarify its theoretical significance in this context.

2.2 Meaningful digital pedagogy

Digital pedagogy refers to the use of digital technologies to support and enhance teaching and learning. It includes a wide range of approaches and technologies, including online learning platforms, educational software, and social media. The word "meaningful" in educational contexts is often linked to the concept of meaningful learning, which occurs when new knowledge is consciously anchored in the learner's pre-existing cognitive structure (Ausubel, 1968). Meaningful learning according to Ausubel (1968) has a long tradition, and these thoughts have been built on by several other researchers, such as Jonassen (1995). The same idea of the word "meaningful" resonates somewhat with this research, but here the focus is more on how digital technologies support teachers in achieving their pedagogical goals, enhancing their instructional practices, and aligning with the practical realities they face in the classroom. Rather than focusing on student learning outcomes, the emphasis is on how technology becomes a purposeful and contextually relevant part of the teachers' professional practice.

Defining digital pedagogy proves to be a complex task, as it can be approached and examined from a multitude of perspectives. When defining digital pedagogy, the focus can extend to a profound level, emphasizing the teachers' perceptions of the ideal learning process, individual learning styles, and methods of teaching and supervision (Mertala, 2019; Mertala, 2017; Udd, 2010; Tondeur et al., 2017). Alternatively, the focus of digital pedagogy may be more practical and revolve around teaching practices—providing a more comprehensive description of how the actual

learning situations and instructional methods are arranged when digital technologies are implemented (Harmes et al., 2016; Prestridge, 2012; Sailin & Mahmor, 2018). Sometimes the focus lies in the teachers' ability to integrate technologies successfully in their teaching (Apelgren & Giertz, 2010; From, 2017; Mishra & Koehler, 2006; Redecker, 2017). Generally, digital pedagogy encompasses the utilization of electronic components to enrich or transform the educational experience (Croxal, 2012; Kivunja, 2013). Digital pedagogy can involve the use of digital technologies to facilitate learning in traditional classroom settings, as well as the development of fully online courses or programs. It can also involve the use of digital technology to support blended learning, where students engage with both online and in-person instruction (Graham, 2013). It is crucial to emphasize the importance of choosing the right tools, given the significant role of digital technologies in digital pedagogy.

Several frameworks and models have been created to conceptualize digital pedagogy and technology integration. Some of the most used frameworks and models are shown in Table 3 below.

Table 3 Frameworks for digital pedagogy and technology integration in education

Davis (1989)	Technology Acceptance Model (TAM)	• Explains how users come to accept and use a technology based on their perceptions of its usefulness and ease of use
Jonassen (1996)	Computers as cognitive tools	• Advocates for a shift in focus from technology integration (the tools used to achieve it) to technology-enabled learning (the pedagogy used to support it)
Mishra and Koehler (2019)	Technological Pedagogical Content Knowledge (TPACK) framework	• Differentiates between three types of knowledge: technological, pedagogical, content, and contextual • Outlines how content (what is being taught) and pedagogy (how it is taught) must form the foundation for any effective educational technology integration
Redecker (2017)	Digital Competence for Educators (DigCompEdu) framework	• Describes what it means for educators to be digitally competent • Focuses on how digital technologies can be used to enhance and innovate education and training
Harmes, Welsh, and Winkelman (2016)	Technology Integration Matrix (TIM)	• Incorporates five interdependent characteristics of meaningful learning environments: active, collaborative, constructive, authentic, and goal-directed • These characteristics are associated with five levels of technology integration: entry, adoption, adaptation, infusion, and transformation

These frameworks and models often provide a structured approach to understanding and implementing digital pedagogy concepts. The Technology Acceptance Model (TAM) focuses on how users come to accept and use a technology based on their perceptions of its usefulness and ease of use. It suggests that these perceptions influence their attitude toward the technology, their intention to use it, and ultimately, their actual use of it. (Davis, 1989.) TAM has been employed to investigate the adoption of new technologies in educational environments, which include everything from social media platforms to advanced tools such as teaching assistant robots, simulators, and virtual reality systems that enhance the learning process (Granić, 2022). According to Jonassen (1996), digital pedagogy is about using digital technologies and resources to provide teachers with the necessary knowledge and competencies to teach. It encompasses teaching and learning in online, hybrid, and face-to-face environments. Digital technologies are positioned to serve as core motivators in the transformation and reform of education (Jonassen, 1996.) Thus, while TAM focuses on technology adoption, Jonassen (1996) advocates for a broader shift from merely integrating technology into teaching toward focusing on technology-enabled learning. Jonassen (1996) emphasizes that the key role of digital pedagogy is not just in the use of digital technologies but in how those tools can support and enhance pedagogical practices to enhance the learning process.

Similarly, more recent frameworks such as Technological Pedagogical Content Knowledge (TPACK), the Digital Competence for Educators (DigCompEdu) framework, and the Technology Integration Matrix (TIM) build on this view by emphasizing the role of technology in supporting educational goals. The TPACK framework, proposed by Mishra and Koehler (2006), extends Jonassen's (1996) and Davies' (1989) ideas by focusing on the intersection of technological knowledge, pedagogical knowledge, and content knowledge. It builds on Jonassen's (1996) ideas by offering a more detailed breakdown for educators on how to seek balance in these knowledge areas and understand how they intersect to make informed decisions about using technology in their teaching (Mishra & Koehler 2006). The more recent conceptualization of TPACK by Mishra (2019) also includes contextual knowledge highlighting the organizational and situational constraints that teachers work within. Despite the comprehensive nature of TPACK, Valtonen et al. (2022) found that Pedagogical Content Knowledge (PCK) was emphasized while Technological Pedagogical Knowledge (TPK) remained underdeveloped in teacher training. Additionally, Brianza et al. (2024) raise the need for teacher education programs to integrate greater awareness of the realities of schools. This imbalance suggests a need to discuss the role of technology more closely in pedagogical practices (Valtonen et al., 2022). The DigCompEdu framework is based on work carried out by the European Commission's Joint Research Centre (JRC). With the DigCompEdu framework Redecker (2017) provides a general reference frame for educators to assess and enhance their digital competencies

across multiple dimensions, including professional engagement, digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' digital competence. Thus, DigCompEdu takes a broader approach by promoting digital competence, which encompasses not only technical skills and pedagogical expertise but also the responsible use of technology. Furthermore, it encourages educators to become lifelong learners of digital technologies themselves, promoting organizational communication, collaboration, and reflective practice. (Redecker, 2017.)

The Technology Integration Matrix (TIM), developed by the Florida Center for Instructional Technology, provides a framework for teachers and administrators to evaluate and plan technology integration in classrooms. It emphasizes five key attributes of meaningful learning environments: active, collaborative, constructive, authentic, and goal-directed (Harmes et al., 2016). These attributes guide the use of technology to foster deeper student engagement, critical thinking, and real-world application of skills. TIM also identifies five levels of technology integration: entry, adoption, adaptation, infusion, and transformation. These levels describe the progression of technology use, from replacing traditional tools to creating entirely new learning environments that are only possible with advanced technologies such as virtual reality or artificial intelligence. Thus, TIM adds a developmental perspective, offering a framework for how teachers can progressively integrate technology to support higher levels of student engagement and learning outcomes. Unlike DigCompEdu or TPACK, which focus on teacher competencies, TIM helps educators evaluate and advance their technology integration practices across different levels—from entry-level adoption to the transformation of learning experiences. The higher level you are in as a teacher is making your pedagogical choices more reliant on the digital technology. This can also work as a driving force for the teacher to change views about teaching and help realize that technologies can be used to shape the whole learning process and not just mimic the old ways of teaching. As such, the higher levels of technology integration within TIM seems to have more in common with the constructivist and socio-cultural approach (Vygotsky, 1978) to teaching because they emphasize the learners' roles in constructing their own knowledge (Milton & Vozzo, 2013; Prestridge, 2012; Udd, 2010). Additionally, it is worth noting that constructivist and socio-cultural approaches may be influenced by the features of digital technologies, as they can enable teachers to design learning environments that support student collaboration, problem-solving, and knowledge construction (Butler et al., 2017).

TIM can be a useful tool for educators looking to integrate technology into their teaching practice in a meaningful way, and for administrators looking to evaluate the level of technology integration in their schools. The mentioned levels provide a reflection tool for teachers to evaluate their own current pedagogical practices. It is worth emphasizing that the existing frameworks and models, such as TPACK,

DigCompEdu, and TIM, offer some perspectives on how to conceptualize meaningful digital pedagogy. TIM emphasizes the active role of learners as part of the learning process. Greenlaw (2015) however states that teacher-centered and learner-centered pedagogies should not be regarded as inherently less effective than one another. Teachers should try to find a balance between these approaches when integrating digital technologies into their teaching methods (Greenlaw, 2015). Adam (2017) cautions against automatically labelling technology-integrated pedagogical practices as constructivist. In their research, Hinostroza et al. (2016) observed that teachers often integrate digital technologies with conventional teaching methods meaning that technologies are primarily used to support classroom management, presentation of information and delivery of instructions (Hinostroza et al., 2016). Montebello (2017) and Saarinen (2020) also argue that digital technologies do not guarantee improved learning outcomes and that teachers must continue to fulfil their traditional roles as facilitators, and leaders in the learning process.

Overall, the goal of digital pedagogy is to leverage the power of technology to enhance the teaching and learning process. Rust (2019) also points out critical approach towards digital pedagogy as it should not necessitate adoption of all emerging technologies. Rather, it advocates for the selective integration of tools that genuinely enhance learning efficiency (Juuti et al., 2022; Rust, 2019). The meaningfulness of the pedagogical use of digital technology can be defined using Jonassen's (1996) categorization, which is based on how the student utilizes technology: 1) learning from technology where technology is the object of learning, 2) learning with technology where technology is a tool for knowledge production, and 3) learning through technology where technology is a cognitive tool. This categorization emphasizes the role of technology in supporting active learning and providing learners with opportunities to engage with content in ways that are meaningful and contextually relevant (Jonassen, 1996; Jonassen, 2000; Jonassen & Reeves, 1996). This framework is often discussed within the context of constructivist learning theories, which emphasize learning as an active, contextualized process of constructing knowledge rather than passively acquiring it (cf. Biggs, 1996; Dewey, 1938; Hohebein, 1996; Vygotsky, 1978). Thus, most of the researchers of the topic seem to agree that technology should be utilized as a partner rather than a teacher. Especially Vygotsky's (1978) sociocultural theory laid the groundwork for social constructivism, proposing that learning involves a sequence of internal or mental transformations. This process includes the evolution of 'higher thought' and the development of concepts (Vygotsky, 1978).

In this research, meaningful digital pedagogy is understood as the use of digital technologies as a part of teaching methods in a way that enhances the learning process. At its core, meaningful digital pedagogy is about using digital tools and technologies to somehow improve the learning process, rather than just replace pre-existing teaching methods (Butler et al., 2017; Greenlaw, 2015; Sailin & Mahmor,

2018). This can include using digital resources such as online learning platforms, educational applications, and social media to support in-person instruction. In the current research literature student-centered learning is mentioned as a key component of meaningful digital pedagogy (Engeness & Edwards, 2016; Tondeur et al., 2017; Wadmany & Kliachko, 2014). Wadmany and Kliachko (2014) emphasize that while technology forms the core of digital pedagogy, its benefits cannot be fully realized without the implementation of suitable pedagogical strategies. In the context of digital pedagogy, the teacher's role is not just to deliver content, but to foster collaborative learning among students and motivate them to take charge of their own learning process (Wadmany & Kliachko, 2014). This idea is supported by Engeness and Edwards (2016), who view the teacher as a facilitator who supports students' collaboration and guides them to use digital technologies in a meaningful way. Digital technologies can be used to personalize the learning experience for each student, providing them with access to resources and activities that are tailored to their learning styles and preferences (Zheng et al., 2022). Another important aspect of meaningful digital pedagogy is the emphasis on problem solving and social knowledge construction. Wadmany and Kliachko (2014) argue that digital technologies can be used to support activities that encourage students to analyze, evaluate, and synthesize information from a variety of sources. They can also be used to facilitate creative expression and collaboration, allowing students to work together on projects and share their ideas and perspectives with others (Wadmany & Kliachko, 2014).

2.3 Enhancing digital pedagogy in teacher education practicums

Teacher education has become a top priority on the education policy agenda worldwide, driven by a common belief that teaching is a critical school-related factor influencing student achievement (OECD, 2018; UNESCO, 2021). Consequently, teacher education and professional development are recognized as key elements in cultivating effective educators (Darling-Hammond, 2017). It is widely agreed that collaboration between teacher education universities and schools is beneficial for both of the organizations. This belief is rooted in various studies that emphasize the importance of collaboration and community involvement in the educational process (Admiraal et al., 2021; Cifuentes et al., 2011; Danaher et al., 2009; Jäppinen et al., 2016; Lomos, 2017; Pang & Wang, 2016; Zheng, Yin, & Li, 2019).

Niemi et al. (2013) suggest that a school culture which is receptive to risk-taking, sharing and teamwork encourages staff to experiment with new technologies, which thereby creates empowering learning environments for learners. Schools that effectively use digital technologies were also found to have a strategy that was planned together by school principals, teachers and often other stakeholders as well,

such as parents (Niemi et al., 2013; OECD, 2018; Polly et al., 2015). Research focusing on considering the university's role in developing the pedagogical use of digital technologies in basic education is, however, scarce. Teacher educators and pre-service teachers could act as collaborators in planning the effective use of digital technologies. Teacher education programs in Finland are designed to equip teachers with the ability to independently solve problems by leveraging the latest educational research. As such, creating a connection between practical experience and academic research is an important aspect implemented in Finnish teacher education (Toom et al., 2010). Mäkiniemi et al. (2017) discovered that collaborative efforts towards digitalizing schools can support teachers' professional growth in several ways. Key benefits identified include the accumulation of knowledge and increased use of digital tools, promoting peer support and thus, easing the burden on those who had been supporting others on their own (Mäkiniemi et al., 2017).

In the field of teacher education technology plays two distinct roles. Firstly, digital technologies may serve as tools for improving the quality of learning experiences that pre-service teachers receive during teacher education. Secondly, teacher education should provide them with skills future teachers need to teach in technologically rich school environments or support the digital transformation of the school culture (Consoli et al., 2023; Kaminskienė et al., 2022; Wohlfart & Wagner, 2023). Ngao et al. (2022) discovered that sometimes teacher educators lacked a clear understanding of the rationale for integrating digital technologies into their teaching. The same teacher educators often questioned the effectiveness of digital technologies as a part of their teaching methods. Teacher educators may also face other challenges, such as limitations in equipment, heavy teaching workloads, and time restrictions when integrating technologies into their teaching. Other teacher educators, on the other hand, were found to use a range of software and online platforms, including social media and journal subscriptions, to access learning materials, but the study found a significant lack of integration of technology in a way that supports pedagogically sound teaching methods (Ngao et al., 2022). This finding aligns with the results from Amhag et al.'s research (2019), which raised the issue that although teacher educators used digital technologies, they were not mainly used for pedagogical purposes. Kaminskienė et al. (2022) argue that it would be beneficial for pre-service teachers' learning to be able to practice skills that are needed in classroom teaching while simultaneously deepening their theoretical understanding of teaching and learning processes. Furthermore, Pappa et al. (2024) found in their study that both pre-service and in-service teachers acknowledged the need to establish teaching communities as collaborative environments where they could share knowledge and learn from each other's experiences.

In Finnish teacher education, the practicum periods have played a focal role in the training of pre-service teachers as they offer a valuable window for the exploration and cultivation of their future professional identities and competencies (Kahila

et al., 2023; Puroila et al., 2021). Similar results have been found in international research as well (Anspal et al., 2019; Çapan & Bedir, 2019; Mukeredzi & Manwa, 2019; Wang & Apraiz, 2018). Teacher education practicum periods are part of the teacher education curriculums (Toom & Husu, 2021). In this research under a relativist ontology, the teacher education practicum is viewed as a dynamic and complex environment where multiple realities coexist and are shaped by the interactions between the participants: pre-service teachers, mentor in-service teachers, and university teacher educators. Relativist ontology acknowledges that each participant brings their own beliefs, values, experiences, and understandings to the practicum, influencing what co-development of meaningful digital pedagogy should entail. The ontology of social constructivist paradigm can be described as relativist as it asserts that reality is not a fixed entity but is continuously constructed and reconstructed through human activities and interactions (Lincoln et al., 2018). It suggests that there are multiple, equally valid realities that are context-dependent and subjective, and challenges the idea of a single, objective reality.

According to Puroila et al. (2021), in-service teachers simultaneously undertake two distinct roles during teacher education practicums. One role involves educating school-age students, while the other focuses on serving as a mentor for pre-service teachers. This continuous engagement ensures their ongoing growth and development as both a teacher and a mentor throughout their career. The practicum periods provide environments that make this dual-role engagement possible (Blomberg, 2014; Orland-Barak & Wang, 2021; Puroila et al., 2021). In the Finnish context it has been found that pre-service teachers consistently express the need for more practical teaching experience, highlighting a strong desire to spend more time in schools during their initial teacher education (Juuti et al., 2018; Paksuniemi et al., 2021). Similar results have been found in international contexts as well (cf. White & Forgasz, 2016). Teacher education practicums are a shared context for universities and schools where universities are expected to provide theoretical and research-oriented expertise, while schools offer structured learning environments. This collaboration fosters reciprocal learning opportunities for pre-service teachers, in-service teachers, and teacher educators (Heikonen et al., 2017; Kyllönen, 2020; Resch et al., 2022; Väätäjä & Frangou, 2021). However, as the practicum experience is divided between two learning environments—universities and schools—there is a risk for a situation where neither the university nor school staff possess a complete understanding of the other's role as part of the learning process. This disconnect can put pressure on pre-service teachers who are trying to integrate theoretical knowledge with practical experience. Often, pre-service teachers are left to independently connect their hands-on learning with the theoretical approaches taught in teacher education. The provision of preparation, follow-up, and support is sometimes unstructured, rather than systematic, requiring pre-service teachers to continually oscillate between action and reflection (Brouwer & Korthagen, 2005).

Consequently, the practicum setting becomes an ideal environment for integrating technology in a collaborative way. Teacher educators, pre-service teachers and in-service teachers can combine their strengths, linking theory with technological practice during the practicum and learning from each other. This dynamic extends beyond the pre-service and in-service teacher relationship, offering valuable insights for teacher educators as well. As a result, the practicum becomes a rich learning environment for all participants (Kyllönen, 2020; Helin, 2014). Tiainen et al. (2018) suggest arranging practicums to support learning in teams. Working in teams and helping each other to view classroom situations from different perspectives—which can lead to co-development—fulfils a prerequisite for knowing how to reflect on your own actions. When pre-service teachers are accustomed to reflecting their working principles in teaching practicums throughout their education, they are more inclined to continue this reflective practice in their future working life (Tiainen et al., 2018). Through the combination of teaching, research, and professional development, the practicum experience can help them to develop a deeper understanding of their role as educators and to identify strategies for improving their teaching practice. It can also help them to develop valuable relationships with colleagues in the field, and to build a network of support and collaboration that can be invaluable throughout their careers (Næsheim-Bjørkvik et al., 2019).

3   RESEARCH QUESTIONS

This dissertation addresses the results of the previous empirical research as well as the university teacher educators', pre-service teachers' and in-service teachers' perceptions about the co-development of meaningful digital pedagogy within the context of teacher education practicums. The three sub-studies aim to find an answer to the following main research question: *How does the process of co-developing meaningful digital pedagogy unfold within the learning community context of a teacher education practicum?* The overarching research question was approached through three independent sub-studies with their own aims, research questions, data and methods.

Sub-Study I was conducted as a systematic literature review to become familiar with the prior research regarding digital pedagogy and technology-enhanced teaching practices. The following research questions were set:

1. How are the dimensions of digital pedagogy conceptualized in the current research literature?
2. What kind of model can be defined based on the dimensions of digital pedagogy?

By addressing the previous research questions, Sub-Study I aimed to conceptualize the dimensions and create a model for digital pedagogy to provide tools for using digital technologies in teaching. Based on the findings of Sub-Study I, Sub-Study II was designed to expand and contextualize the topic in the teacher education practicum with a case study approach. This was done to find information on how practices for co-development could be utilized within the context of teacher education practicums. Sub-Study II also examined the pre-service teachers', in-service teachers' and university teacher educators' perceptions of digital pedagogy. The following research questions were set:

1. Which characteristics of a CoP can be recognized in a primary school teacher education practicum?
2. How do the stakeholders perceive digital pedagogy in the context of practices for co-development?

By addressing the previous research questions, Sub-Study II aimed to identify the characteristics of a Community of Practice (CoP) in a primary school teacher

education practicum and participants' perceptions of digital pedagogy in the context of practices for co-development. Based on the findings of Sub-Studies I and II, Sub-Study III utilized a phenomenographic research approach to provide more in-depth information about the collaborative practices related to a learning community approach within the context of teacher education practicum and what makes digital pedagogy meaningful. The following research questions were set:

1. What meanings do participants attribute to the collaborative practices in a teacher education practicum?
2. What are the participants' conceptions of meaningful digital pedagogy in the context of a teacher education practicum?

By addressing the previous research questions, Sub-Study III aimed to identify variations in the meanings related to collaborative practices and conceptions of meaningful digital pedagogy in the context of a teacher education practicum.

4   RESEARCH METHODOLOGY

A qualitative multi-method approach provides methodological guidelines for conducting this research within the social constructivist paradigm, guiding the selection of appropriate methods and approaches (Denzin & Lincoln, 2018; Guba & Lincoln, 1994; Jennings, 2010). In this study, the qualitative multi-methods approach utilizes a systematic literature review, case study, and phenomenographic research approaches in order to yield insightful information relevant to the research issue and answer the research questions. To be more specific, the systematic literature review in Sub-Study I provided an overview of the dimensions of digital pedagogy based on the topical research literature (Creswell, 2018). The case study approach utilized in Sub-Study II contributed to the research specifically focusing on the co-development of digital pedagogy in the context of teacher education practicums (Yin, 2014). The phenomenographic research in Sub-Study III helped find more specific information about the variation in meanings attributed to the collaborative practices and conceptions of meaningful digital pedagogy (Marton & Pong, 2005). Thus, the epistemological approach in Sub-Studies I–III can be described as transactional and inter-subjectivist. The epistemology of the social constructivist paradigm sees knowledge construction as a complex, dynamic process that involves both the interaction with the physical and social world—transactional—and the creation of shared meanings within a community—intersubjective (Denzin & Lincoln, 2005; Lincoln et al., 2018). In the context of this dissertation, the process of knowing is understood not as a static transfer of information from an external world to passive observers but as an active and ongoing engagement between university teacher educators, pre-service teachers, and in-service teachers within the teacher education practicum. Moreover, this view emphasizes the socially situated nature of learning. As Jennings (2010) highlights the role of social interaction in developing understanding, this research focuses on how collaborative practices in the practicum—through the learning community approach—enable university teacher educators, pre-service teachers, and in-service teachers to co-develop meaningful digital pedagogy. The aim was that the combination of the chosen methodologies would together provide useful information about the co-development of meaningful digital pedagogy from multiple perspectives (Denzin, 1978; Silverman, 2010).

Different methodologies are used in each of the Sub-Studies I–III. New methodologies and approaches were chosen as the sub-studies provided more information and the study proceeded further. The reason for this choice was that the

individual sub-studies could provide information to be later utilized in the following sub-studies. Methods are practical and specific tools that are used to gather research material and analyze it (Jennings, 2010). Qualitative analysis methods—thematic analyses, qualitative deductive content analyses and phenomenographic analyses—were applied in the sub-studies. Qualitative analysis methods are generally diverse and have many variations depending on the researcher. Next, the mentioned analysis methods were applied in this study. Table 4 presents and summarizes the sub-studies of this dissertation.

Table 4 Summary of the sub-studies

Aims and Contributions	Research Questions	Data	Methods	Publications
Sub-Study I: Conceptualizing the dimensions and offer a model for digital pedagogy to provide tools for using digital technologies in teaching	1. How are the dimensions of digital pedagogy conceptualized in the current research literature? 2. What kind of model can be defined based on the dimensions of digital pedagogy?	12 empirical articles	Systematic literature review, thematic analysis	**Refereed international scientific journal:** Väätäjä, J., & Ruokamo, H. (2021). Conceptualizing Dimensions and a Model for Digital Pedagogy. *Journal of Pacific Rim Psychology.* https://doi.org/10.1177/18344909219 95395
Sub-Study II: Revealing the characteristics of Community of Practice (CoP) in a primary school teacher education practicum and perceptions of digital pedagogy in the context of practices for co-development	1. Which characteristics of a CoP can be recognized in a primary school teacher education practicum? 2. How do the stakeholders perceive digital pedagogy in the context of practices for co-development?	Instructional documents of a teacher education practicum Transcripts of qualitative interviews with teacher educators (n = 2), pre-service teachers (n = 5), and mentoring in-service primary school teachers (n = 6)	Case study, deductive qualitative content analysis	**Refereed international scientific journal:** Väätäjä, J. (2023). A Community of Practice Approach to the Co-development of Digital Pedagogy: A Case Study of Primary School Teacher Education Practicum. *European Journal of Teacher Education.* https://doi.org/10.1080/02619768.20 23.2198102
Sub-Study III: Identification of variations in the meanings related to collaborative practices and conceptions of meaningful digital pedagogy in the context of a teacher education practicum	1. What meanings do participants attribute to the collaborative practices in a teacher education practicum? 2. What are the participants' conceptions of meaningful digital pedagogy in the context of a teacher education practicum?	Transcripts of four qualitative group interviews involving teacher educators (n = 4), pre-service teachers (n = 8), and mentoring in-service primary school teachers (n = 4)	Phenomenographic research, phenomenographic analysis	**Refereed international scientific journal:** Väätäjä, J., & Korte, S-M., (2023). Exploring the conceptions of meaningful digital pedagogy in the context of teacher education practicums. *Education in the North*, *30*(2), 136–155. https://doi.org/10.26203/4fyb-yy18

The strength of the research lies in its data, which comes from various sources—combining topical research literature, documents from the teacher education practicum and transcripts indicating the research participants' perceptions of reality. In this dissertation qualitative methodologies are utilized in order to yield insightful information relevant to the research issue—co-development of meaningful digital pedagogy in the context of a teacher education practicum. The following section provides a detailed examination of the methodological choices employed in each sub-study.

4.1 Sub-Study I theme: Conceptualizing dimensions and modelling digital pedagogy

4.1.1 Systematic literature review

Sub-Study I was conducted as a systematic literature review to answer the following two research questions: 1) *How are the dimensions of digital pedagogy conceptualized in the current research literature?* and 2) *What kind of model can be defined based on the dimensions of digital pedagogy?* The systematic literature review was a significant part of this research, and it provided information about the current research topic—digital pedagogy. According to Newman and Gough (2020), the activities of 'reviewing the literature' and 'conducting research' have been traditionally considered separate endeavors within the field of education. However, both theoretical reviews and empirical research are pursued with the objective of discovery. This systematic literature review aimed to uncover what was already understood from existing research about a phenomenon, subject, or topic. Conversely, new primary research seeks to answer questions that current research does not address fully or clearly. The rationale behind systematic literature reviews is the understanding that reviews themselves are a form of research that can be enhanced through the application of specific and clearly defined methodologies (Newman & Gough, 2020). The choice for the literature review approach made it possible to recognize dimensions related to the concept of digital pedagogy and matters worth studying in a systematic way (Hart, 1998; Gray, 2004). This was also a way to provide a background for future empirical studies (Xiao & Watson, 2019). The systematic literature review was conducted by the following steps by Creswell (2018):

1. Identify keywords
2. Choose databases
3. Begin searching
4. Locate related articles and books
5. Identify useful literature
6. Design a literature map
7. Assemble the literature review

The literature review process began with the formulation of a research question, followed by the identification of keywords and choosing databases and search engines. After this, the searches were conducted, and the articles that met the predetermined inclusion and exclusion criteria were then taken as research data and analyzed. The literature map was designed to present the results in a transparent and replicable manner, with the aim of minimizing bias and ensuring that all relevant studies were included (Creswell, 2018; Newman & Gough, 2020). The process is presented in detail in the following chapter.

4.1.2 Data collection and analysis

Sub-Study I was conducted as a literature review, and it began by identifying the keywords to be used to locate the articles. Keywords were identified from initial readings and subsequently used as search terms in selected databases. The search terms included "digital pedagogy," "competence," "skill," "knowledge," "pedagogy," "teaching," "digital," "technology," and "pedagogical orientation," along with combinations of these terms. After the identification of the keywords, it was time to choose databases. The following databases were chosen: Academic Search Elite, the Education Resources Information Center (ERIC), and the ACM Digital Library. The information specialist from the Lapland University Consortium Library was consulted regarding the choice of databases and formulating the search terms. Creswell (2018) emphasizes the importance of establishing clear inclusion and exclusion criteria that determine which articles are chosen as the research data. The inclusion and exclusion criteria were formulated at the same time as formulating the initial search terms. The inclusion and exclusion criteria used in Sub-Study I are presented in Table 5.

Table 5 Inclusion and exclusion criteria (Väätäjä & Ruokamo, 2021, p. 5)

Inclusion criteria	Exclusion criteria
- Peer reviewed - Written in English - Published 2014–2019 - Presents empirical or theoretical research - Includes the concept of digital pedagogy - Focuses on the pedagogical use of technology	- Does not focus on teaching - Focuses on the pedagogical use of a specific technology - Focuses on teachers' competencies concerning specific technology - Focuses on teaching about digital technologies

By choosing the years 2014 to 2019 the aim was to focus on the most recent trends, technologies, and pedagogical strategies that were relevant during the time of Sub-Study I in educational contexts. Thus, the focus on pedagogical use of technology and the involvement of the concept of digital pedagogy were set as key inclusion criteria. The inclusion criteria helped to create the search terms and to locate the articles and books relevant to the study. The exclusion criteria were set to aid the exclusion of articles that were not relevant to the study even though they might meet the inclusion criteria. Figure 2 represents the data extraction process of Sub-Study I.
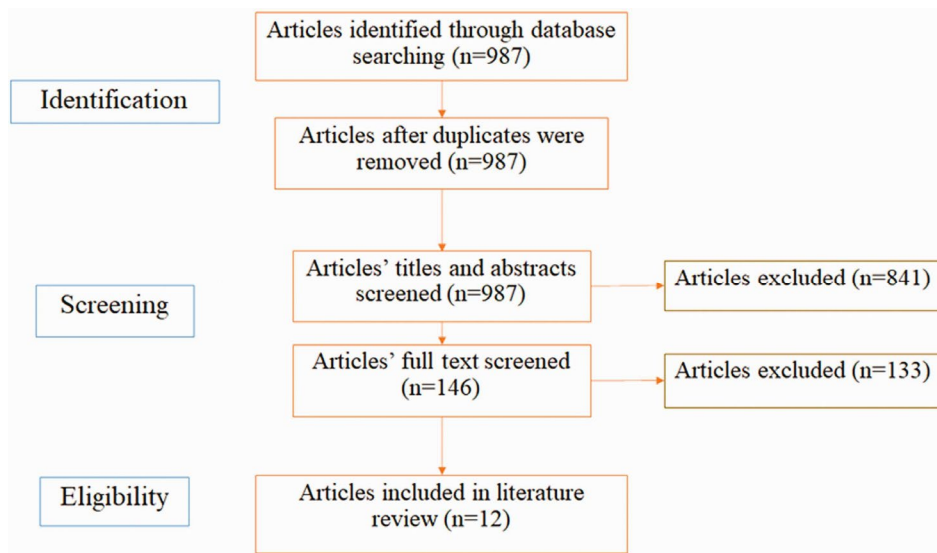
Figure 2 The identification and screening process for the literature used in Sub-Study I (Väätäjä & Ruokamo 2021, p. 5)

The data collection began in Spring 2019 and ended in the beginning of the year 2020. The articles the searches provided were published between the years 2014 and 2019. The literature searches in the chosen databases, Academic Search Elite, ERIC, and ACM Digital Library identified a total of 987 articles that were brought through the screening process. The ERIC database generally yielded the most articles, while the ACM Digital Library database yielded the fewest. The articles found in the ERIC database tended to focus on the pedagogical use of digital technologies or on professional development for teachers through organizational measures. On the other hand, articles in the ACM Digital Library database were mainly related to technology research, but not necessarily related to its pedagogical use. Such cases occurred most often when the article's focus concerned using some

specific technology and its effect on the learning process. These kinds of articles were not included because the aim was to conceptualize a pedagogical model that would provide tools for generally using digital technologies in teaching—not focusing only on the use of one specific technology. The Academic Search Elite database yielded the most relevant articles for this review. All the articles included in this literature review were obtained through these searches. None of the articles published in 2019 met the inclusion criteria. The data is comprised from 12 peer-reviewed empirical articles published between the years 2014 and 2018.

In Sub-Study I a thematic analysis (Braun & Clarke, 2006) was applied as a method for interpreting qualitative data. This consisted of generating initial codes, recognizing themes, naming the main categories, and contextualizing the analysis in correspondence to the existing literature. Although these phases may seem sequential, the analysis is typically a recursive process moving back and forth between these phases (Braun & Clarke, 2006). The analysis process proceeded by entering the data into a qualitative data analysis computer software program NVivo 12. NVivo 12 provided a structured platform for processing the data. Table 6 represents the literature map which consists of the initial codes and recognized categories and their correspondence with the selected studies (n=12).

Table 6 Dimensions of digital pedagogy and their contents by the selected authors

Dimensions of digital pedagogy	Studies	Items from the selected literature
PEDAGOGICAL ORIENTATION	Greenlaw (2015) Wadmany and Kliachko (2014) Montebello (2017)	• Constructivist and learner-centered • Teacher as a facilitator
	Adam (2017) Looi et al. (2014) Pittman and Gaines (2015)	• Traditional, teacher-centered • Constructivist, student-centered • Sociocultural approach
	Gillett-Swan and Sargeant (2017) Pittman and Gaines (2015) Sailin and Mahmor (2018) Wadmany and Kliachko (2014)	• Constructivist approach helps to integrate digital technologies into teaching
PEDAGOGICAL PRACTICES	Wadmany and Kliachko (2014) Sailin and Mahmor (2018)	• Student engagement • Problem-based
	Pittman and Gaines (2015)	• Students as creators of knowledge
	Greenlaw (2015)	• Collaboration
DIGITAL PEDAGOGICAL COMPETENCIES	Mannila et al. (2018)	• Self-efficacy
	From (2017) Mena et al. (2018)	• Knowledge, skills, attitudes, and approaches in relation to digital technology
	McCarthy et al. (2017)	• Technological knowledge • Pedagogical knowledge • Personal support

Table 6 also presents the analysis process as it involves the three dimensions recognized based on the thematic analysis of the data: 1) pedagogical orientation; 2) pedagogical practices; and 3) the digital pedagogical competencies in accordance with the items recognized from the research data. The results are more closely presented in the following section.

4.1.3 Summary and evaluation of the results

Sub-Study I, aimed to conceptualize dimensions and a model for digital pedagogy. The aim of the presented model is to provide tools for teachers to implement digital technologies in teaching. At the time of planning the research, the concept of digital pedagogy was widely used in the topical research literature. In several articles where digital pedagogy was mentioned, it was often left undefined as a concept. The unclear definition of digital pedagogy led to different interpretations and approaches to its use in education. This ambiguity was a challenge, as it hindered the development of a cohesive framework for digital pedagogy. Sub-Study I provided a broader understanding of what digital pedagogy is based on the topical literature beyond the simple use of digital technologies in teaching. The results provided by thematic analysis were used in the conceptualization of dimensions and a model for digital pedagogy, which can be seen in Figure 3.
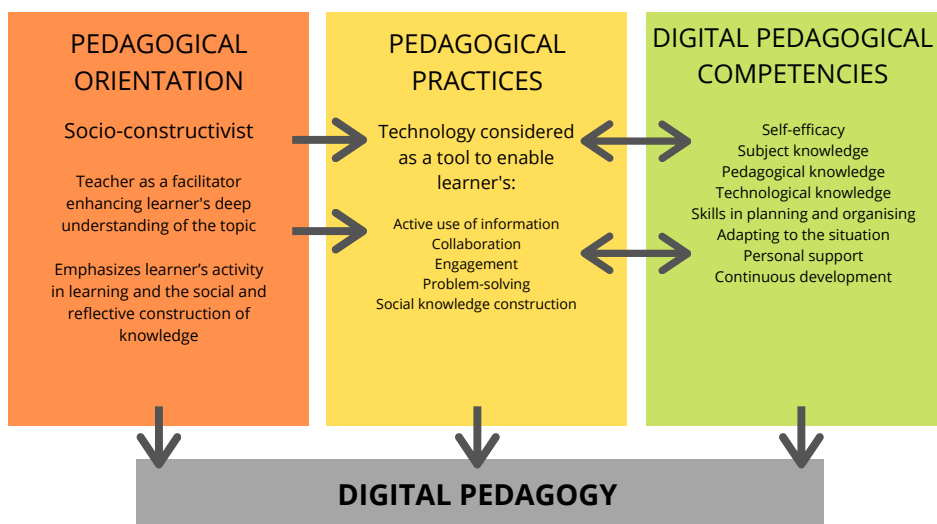
Figure 3 Conceptualization of dimensions and a model for digital pedagogy (Väätäjä & Ruokamo 2021, p. 7)

Figure 3 represents the results that can be used to answer the research questions. Firstly, regarding the first research question: *How are the dimensions of digital pedagogy conceptualized in the current research literature?* In Sub-Study I, the following three dimensions were recognized based on the thematic analysis of the data: 1) pedagogical orientation; 2) pedagogical practices; and 3) digital pedagogical competencies required from the teacher. Secondly, to answer the second research question: W*hat kind of model can be defined based on the dimensions of digital pedagogy?* according to the literature reviewed, there was a prevailing consensus among scholars regarding

the critical role of the teacher's *pedagogical orientation* in the successful integration of technology into education. In the topical literature, the pedagogical orientation of digital pedagogy is most often comprised of a social constructivist approach to teaching where teachers are seen as facilitators supporting learners' activeness in the learning process and social knowledge construction (Wadmany & Kliachko, 2014). Specifically, it was widely agreed that technological integration is most likely to yield positive outcomes when educators adopt a social constructivist and student-centered approach to pedagogy. A student-centered approach to pedagogy refers to engaging students to take responsibility for their own learning process (Greenlaw, 2015; Montebello, 2017; Wadmany & Kliachko, 2014). *Pedagogical practices* are planned so that digital technologies enable learners to use information actively, collaborate, engage, solve problems, and construct knowledge while interacting with each other. Thus, digital pedagogy should encompass more than merely utilizing digital technologies in the classroom.

Additionally, the reviewed literature consistently emphasized that teachers need more than a basic understanding of technology, pedagogy, and content knowledge to effectively integrate digital technology into their teaching practices (cf. Mishra & Koehler, 2006). Regarding *digital pedagogical competencies*, skills in planning and support from colleagues were highlighted as essential as previously mentioned knowledge areas. Effective planning involves not only selecting appropriate digital tools but also planning learning experiences that align with educational goals and student needs. Furthermore, the importance of collaborative support from fellow educators was emphasized. Self-efficacy also emerged directly from the reviewed literature. It is noteworthy, however, that the data included references related to the concept, but it was not sufficiently connected to the broader framework of self-efficacy by Bandura (1977a; 1997). In conclusion, recognizing these key elements can help educators navigate the evolving landscape of digital pedagogy and enhance their teaching practices. The study was conducted as a systematic literature review, which helped gain an understanding of the context of the research phenomenon at the moment. The concept of digital pedagogy plays a focal part in this dissertation, and thus, I wanted to dedicate the first sub-study to capturing, evaluating, and summarizing the literature related to it in a systematic literature review approach.

However, it is essential to review the conducted study in a critical manner and be open about the possible limitations regarding it to help other researchers of the field to consider them when conducting their own studies. One important issue is that the relatively low number of articles were found to pass the exclusion criteria of the literature review, which can be seen as an interesting result. The absence of detailed and precise information evidently reduced the number of articles that could be considered for Sub-Study I. A significant number of articles that did not meet the necessary criteria were excluded during the initial screening of the titles and abstracts. An alternative approach could have been to investigate the pedagogy of technology

integration on a more general level. Furthermore, an alternative approach could have involved including articles where digital pedagogy was mentioned but not formally defined. During Sub-Study I, the systematic review's scope was limited to articles that explicitly provided a definition for "digital pedagogy." An inclusive strategy might have provided different results but would have required a different type of analysis.

The model presented offers a rather vague depiction of the involvement of digital technologies within the various conceptual dimensions, including pedagogical orientation, pedagogical practices, and digital pedagogical competencies. Additionally, the dimensions outlined in the model seem to be impractical for real-world use, which makes it difficult for teachers to implement the model in their day-to-day teaching. Sub-Study I highlighted the necessity for empirical methods that can be employed to assess and enhance the model, thus aiding educators in using digital technologies for teaching. The literature review, however, provides a beneficial foundation for researchers who are in the process of acquainting themselves with the field of study as I also was. It is also worthwhile noting that the literature review was conducted during the time before the peak of the COVID-19 pandemic. If the literature review had been conducted in 2024, it might have provided different results because the pedagogical use of technologies underwent rising interest due to the move from contact teaching to distance teaching. Overall, systematic literature review as a methodological approach was a useful tool for synthesizing and summarizing large bodies of research, providing a comprehensive overview of the current state of knowledge on a specific topic and identifying gaps in the existing literature.

4.2   Sub-Study II: A community of practice approach to the co-development of digital pedagogy

4.2.1   Case study

Sub-Study II was conducted as a case study because it aimed to answer two research questions: 1) *Which characteristics of a CoP can be recognized in a primary school teacher education practicum?* and 2) *How do the stakeholders perceive digital pedagogy in the context of practices for co-development?* Sub-Study II used a case study (Yin, 2014) research methodology to examine a phenomenon in its natural setting. This allowed for a detailed exploration of how specific case characteristics interact with broader principles (Tierney & Dilley, 2001; Yin, 2014). Predominantly utilized within the domains of social sciences, education, psychology, and business studies, case studies are particularly suitable for investigating phenomena that cannot be disentangled from their context. The case study can involve the use of multiple data collection methods—in this case transcripts of qualitative interviews and instructional

documents of the guided field practicum—thus allowing for triangulation in data analysis and enhancing the validity and reliability of the findings (Creswell, 2014; Yin, 2012). Furthermore, case studies are important for developing theories and providing valuable insights that can lead to creating hypotheses for further testing (Yin, 2014).

According to Yin (2014), case study is a suitable approach, especially when the researcher cannot influence the behavior of those involved in the study. In Sub-Study II, I gathered information about the current state of the practices in the teacher education practicum and did not aim to manipulate them during that time. The aim was to collect information that could be later used in developing the practices of the teacher education practicum. Yin (2014) categorizes case studies as descriptive, explanatory, or exploratory in nature. The case in Sub-Study II can be defined as exploratory because it lacked detailed preliminary research about the Community of Practice approach, which was used to define the practices of co-development in the context of teacher education practicum. The case study approach is especially suggested in cases where the focus of the study is to seek answers to questions "how" and "why" (Yin, 2014). Yin (2014) and Creswell (2013) also provide detailed designs for using multiple cases in a single study. Sub-Study II sought to provide solutions for the pre-set research questions through a single case related to a teacher education practicum.

4.2.2 Data collection and analysis

Sub-Study II was conducted as a case study, and it involved qualitative interviews with teacher educators (n=2), pre-service teachers (n=5), mentor in-service teachers (n=6), and examined instructional documents of the guided field practicum. The teacher educators, pre-service teachers and mentor in-service teachers were all associated with the guided field practicum which is the last practicum period pre-service teachers complete during the final year of their studies (see chapter 1.3). Both of the data sets were collected in the autumn of 2019. Table 7 represents the number of participants and the amount of the interview data.

Table 7 Participants and the amount of interview data

Participant categories	Number of participants	Interview data (word count)
Teacher educators	2	5,470 words
Pre-service teachers	5	7,756 words
In-service teachers	6	12,098 words
Total	**13**	**25,324 words**

The interviews lasted 20–30 minutes, depending on the participant. Some of the participants had more to say than others. The interviews were audio recorded by phone and later transcribed verbatim. The transcribed text files were anonymized so

that individual participants' answers could be referred to by using a code (e.g., pre-service teacher 1). This study adhered to Warren's (2001) principles of the qualitative interview process, which he characterizes as a guided conversation. The interviews were preferably arranged in person as it made it possible to observe the participant's body language and facial expressions (Wilson, 2016). Three of the interviews were, however, carried out over the phone because the participants preferred it that way. It is noteworthy that the data collection was conducted during the COVID-19 pandemic, and some people working in schools preferred to avoid unnecessary in-person interactions. The interviews were conducted using a semi-structured interview design (Wilson, 2016) to foster a conversational atmosphere during the interview situations. The semi-structured interview design allowed minor changes to be made to the interview questions during the interviews to lessen the chances of leaving valuable information out of the study (Wilson, 2016). The interviews comprised firstly questions related to the practices supporting co-development (e.g., *What was your role in the co-development?*) and secondly, the co-development of digital pedagogy (e.g., *What should be the role of digital technologies in the classroom?*) (See Appendix 1). The interview questions were discussed beforehand with colleagues at the Faculty of Education at the University of Lapland. The discussions helped to prepare the interviews. Dilley (2000) emphasizes that thorough preparation enables the researcher to concentrate on the interview, making it easier to compare the participant's responses and the researcher's existing knowledge on the subject.

The instructional documents here refer to the guided field practicum's course description and instructions for the in-service teacher who is to mentor the pre-service teacher during the practicum. Table 8 represents the length of the material provided by the instructional documents.

Table 8 Types and amount of the instructional documents

Instructional document	Length of the material (word count)
The guided field practicum's course description	217 words
Instructions for mentor in-service teacher	162 words
Total	**379 words**

The course description comprises the learning objectives, content, and teaching and learning methods. The structure regarding course descriptions within Finnish universities are quite common. Instructions for the mentor in-service teacher provide guidelines about the teacher's responsibilities, such as inducting the pre-service teacher into the school environment in the practicum. The instructions for mentor in-service teachers are meant to make it clear for both the mentored pre-service teacher and the mentor in-service teacher to know what the role of the in-service teacher is and what is expected of them during the practicum.

In Sub-Study II a qualitative content analysis (Drisko & Maschi, 2015) with a deductive approach (Elo et al., 2014) was used for interpreting the collected data. The analysis in Sub-Study II differs from the other sub-studies in its deductive approach. A deductive content analysis begins by forming a categorization matrix based on a predetermined theory, which in this case was the framework for Wenger's (1998) Community of Practice (CoP). The deductive approach resulted in the identification of five criteria from Wenger's (1998) description of CoP: 1) negotiated goals, 2) addressed challenges, 3) regular and intentional interaction, 4) co-development of the community, and 5) leveraged individual's expertise. I used NVivo 12 to code five identified criteria and find examples of each in the gathered data. I also used this process to identify which criteria were not met. Table 9 shows the identified criteria characterizing the co-development of digital pedagogy.

Table 9 Identified criteria for characterizing the co-development of digital pedagogy (Väätäjä 2023, p. 9)

Element of CoP	Criteria for characteristics	Items from the instructional documents and interviews
DOMAIN	Negotiated goal(s)	• Discussed in a meeting between the stakeholders • Based on the pre-service teachers' interests and the schools' needs • Activation and collaboration through digital pedagogy
	Addressed challenges	• From the school context • Lack of induction • Amount of usable technologies • Lack of time
COMMUNITY	Regular and intentional interaction	• Pre-service teacher/in-service teacher interaction in the school environment • Teacher educator/pre-service teacher interaction in master's thesis seminars
PRACTICE	Co-development of the community	• Meaningful digital pedagogy • Pre-service teacher's role emphasized in co-development • In-service teacher as a supervisor • Teacher educator as a prospector
	Leveraged individual's expertise	• Pre-service teachers' technological pedagogical knowledge • In-service teachers' subject knowledge and familiarity with the school and classroom practices

Table 9 also presents the analysis process as it describes the identified criteria: *negotiated goals*, *addressed challenges*, *regular and intentional interaction*, *co-development of the community*, and *leveraged individual's expertise* in accordance with the items recognized from the research data. The results are more closely presented in the following section.

4.2.3 Summary and evaluation of the results

Sub-Study II was conducted as a case study that aimed to identify which characteristics that define the concept of a Community of Practice (CoP) could be recognized in a primary school teacher education practicum and how stakeholders perceived digital pedagogy in the context of practices for co-development. Firstly, regarding the first research question: *which characteristics of a CoP can be recognized in the primary school teacher education practicum?* in Sub-Study II the results indicated that various practices within the practicum did align, to some extent, with the five criteria associated with CoPs: *negotiated goals*, *addressed challenges*, *co-development of the community*, *leveraged individual expertise*, and *regular and intentional interaction*. The instructional documents and the perspectives of the stakeholders interviewed showed a difference. While the documents did not provide clear guidance on co-development, the stakeholders felt that co-development did happen in the practicum. The results of Sub-Study II suggest that including specific characteristics that support the CoP concept in instructional documents could improve reflection and co-development among practicum stakeholders. Sub-Study II also emphasized the need to redefine the role of teacher educators within the practicum. While teacher educators were involved in goal setting, they were not actively engaged in the co-development processes on site. On the other hand, also the mentor in-service teachers often had a more observational role rather than being actively involved in co-development. Sub-Study II recommends increased collaboration between teacher educators and pre-service teachers, particularly in the area of lesson planning. It is also noteworthy that in some cases, pre-service teachers' master's theses topics aligned with the negotiated goals of the practicums. Involving research in practicum could help not only the pre-service teachers but also teacher educators and in-service teacher create connection between theory and practice (cf. Eklund, 2014; Puustinen et al., 2018). Thus, it would be beneficial to investigate more how aligning the practicum goals with master's theses topics affects the practices for co-development. It also suggests that technology could be used to support stakeholder communication and involvement during the practicum, when they cannot be physically present.

The second research question was: *how do the stakeholders perceive digital pedagogy in the context of practices for co-development?* Results indicated that co-development projects primarily revolved around the use of various technologies in teaching and were linked to negotiated goals set by stakeholders. The in-service teacher

mentors sought technological pedagogical knowledge as they wished to learn more about solutions and how various technologies could be implemented as a part of teaching practices. There was a clear division of tasks between in-service teachers and pre-service teachers. In-service teachers were mainly responsible for teaching subject matters, while pre-service teachers focused on integrating technology as a part of teaching practices. Thus, co-development mainly took place at the level of individual lessons. Achieving comprehensive co-development, especially at the level of courses or school organizational matters, would require more intentional planning and involvement from mentor in-service teachers. School administrations should acknowledge practicums as opportunities for co-development, and discussions on the impact levels of co-development should be part of goal-setting negotiations. Overall, Sub-study II presented a strategy for implementing CoP as a concept in teacher education practicums, connecting university personnel, students, and school personnel to work toward common goals. Further research is needed to clarify the roles of key stakeholders and explore how CoP practices are connected to stakeholder learning. This exploration could help us better understand the benefits of using CoP in teacher education and school contexts.

The strengths of case study research include providing a rich and detailed understanding of a specific case, identifying unique and complex relationships between different variables, and generating hypotheses or theories for further research. However, single-case studies may be limited by their focus on a single case, which can limit the generalizability of the findings. Especially as the teacher education practicums are highly regulated by the practices of the university organizing them, which in this case was the University of Lapland. This case study aimed to address this challenge by following Yin's (2014) recommendations and providing detailed reports of the analysis process. However, the approach used to implement the concept of Community of Practice (CoP) in teacher education shows potential. Sub-Study II could have benefitted from including another framework for characterizing digital pedagogy. A similar kind of qualitative content analysis carried out deductively could have been conducted in accordance with the Technology Integration Matrix (TIM) by Harmes et al. (2016) or the Technological Pedagogical Content Knowledge (TPACK) framework by Koehler and Mishra (2006) for example. The foundation of Sub-Study II is based heavily on theoretical premises, aligning with the characteristics of deductive content analyses. An inductive content analysis would have allowed the themes and categories to emerge from the data itself rather than being predefined by a theoretical framework or prior hypotheses.

4.3 Sub-Study III: Exploring the conceptions of meaningful digital pedagogy in the context of teacher education practicums

4.3.1 Phenomenographic research

Sub-Study III was conducted as phenomenographic research, and it aimed to answer the following two research questions: 1) *what meanings do participants attribute to the collaborative practices in a teacher education practicum?* and 2) *what are the participants' conceptions of meaningful digital pedagogy in the context of a teacher education practicum?* Phenomenography qualitatively investigates people's different ways of experiencing and thinking about a certain phenomenon. Tracing its origins to Greek etymology, with "phainomenon" translating to "appearance" and "graphein" translating to "description," phenomenography can be succinctly described as the "description of appearances." (Orgill, 2012.) Phenomenography is a methodological approach that attempts to study human thinking (and possibly acting) from a non-dualistic perspective, that is, an attitude where the internal thinking and external world are not set as separate entities (Säljö, 1997). When phenomenography describes perceptions of the surrounding world, these perceptions and ways of understanding are not considered as individual characteristics. Rather, perceptions of reality are seen as descriptive categories used to facilitate the understanding of people's concrete actions. Since the same descriptive categories occur in different situations, the set of categories is thus stable and generalizable across situations, even though individuals might move from one category to another in different situations. (Marton, 1981.) In Sub-Study III, the term "conceptualize" is preferred over "experiencing" or "understanding" to emphasize the focus on conceptual attributes rather than sensory-related aspects. Here, "conception" serves as the fundamental unit of description (Marton & Pong, 2005).

A phenomenographic research methodology was selected because the interest lies in the diverse conceptions individuals hold about collaborative practices and meaningful digital pedagogy in the context of a teacher practicum. This methodology was fitting for the study, as it allowed for the exploration of the multifaceted social phenomenon of conceptualizing collaborative practices and meaningful digital pedagogy within the teacher education practicum. This phenomenon is defined by diverse domains of expertise as it involves teacher educators, pre-service teachers, and in-service teachers with varying backgrounds, all set against the rapidly changing digital and educational landscapes. The methodology's main goal was not to delve into the meanings of various phenomena or the thought processes of individuals. Rather, its primary objective is to uncover the variation in ways individuals describe, interpret, and conceptualize phenomena—providing insights into the range of possible conceptions within a particular context (Marton & Pong, 2005; Sin, 2010; Svensson, 1997).

4.3.2 Data collection and analysis

The data was collected in four group interviews which were conducted once for every group. Each group consisted of one university teacher educator, two pre-service teachers, and one mentor in-service teacher; thus, there were a total of 16 participants in the four groups. The teacher educators, pre-service teachers, and mentor in-service teachers were all associated with the guided advanced practicum, which is the second last practicum period pre-service teachers complete during the fourth year of their studies (see chapter 1.3). The research aim was presented to the participants before beginning the interview (see Appendix 2). A semi-structured interview format was used, allowing for conversational quality and flexibility in asking follow-up questions. The interviews consisted of questions related to two themes: one focusing on collaborative practices and the other on conceptions of meaningful digital pedagogy in the context of teacher education practicums (see Appendix 3). The interviews aimed to gather detailed perspectives on these themes. Table 10 presents the amount of the group interview data.

Table 10 Participant groups and the amount of group interview data

Participant groups	Interview data (word count)
Group 1 • pre-service teacher 1 • pre-service teacher 2 • in-service teacher 1 • university teacher educator 1	5,020 words
Group 2 • pre-service teacher 3 • pre-service teacher 4 • in-service teacher 2 • university teacher educator 2	5,177 words
Group 3 • pre-service teacher 5 • pre-service teacher 6 • in-service teacher 3 • university teacher educator 3	3,546 words
Group 4 • pre-service teacher 7 • pre-service teacher 8 • in-service teacher 4 • university teacher educator 4	4,167 words
Total	*17,910 words*

Each of the interviews lasted 30–40 minutes. The group interviews were audio-recorded by phone and later transcribed verbatim. The transcribed text files were anonymized in a similar manner as in Sub-Study II (see 4.2.2). Recorded audio files were stored on a personal OneDrive for Business folder, which the University of Lapland provides to its personnel. The stored data was encrypted to guarantee the participants' privacy. The qualitative data analysis software Nvivo 12 was also utilized in Sub-Study III.

A qualitative phenomenographic analysis was used as an analysis method in Sub-Study III and it involved categorizing the different conceptions and identifying underlying structures in the participants' responses (Svensson, 1997). The goal was to uncover the qualitatively distinct ways in which individuals conceptualize the phenomenon of meaningful digital pedagogy and collaborative practices within the context of teacher education practicum. The analysis sought to explore the different ways in which individuals conceptualize collaborative practices and meaningful digital pedagogy in the context of a teacher education practicum. To explore the diverse conceptions among pre-service teachers, mentor in-service teachers, and university teacher educators regarding meaningful digital pedagogy and their collaboration within the context of teacher education practicums, the data was analyzed and segmented into units of description. Through a meticulous process of organizing and reorganizing these units, categories of description were formed. The goal was to distill these varied conceptualizations into broader themes, demonstrating how understanding deepens along a specific theme as one moves from more basic to more complex ways of engaging with the phenomenon (Åkerlind, 2018). Sub-Study III developed an outcome space to represent the hierarchical relationships among the identified conceptions—at the same time, providing an understanding of the phenomenon to be used in future research and to develop educational practice (Åkerlind, 2005).

4.3.3 Summary and evaluation of the results

Sub-Study III aimed to identify meanings attributed to the collaborative practices and conceptions of meaningful digital pedagogy in the context of a teacher education practicum. In Sub-Study III it was revealed that the members of the learning community may attribute various meanings to the collaborative practices within the context of a teacher education practicum. The meanings were coded as units of description which were clustered in description categories. The description categories were made to describe the range of the meanings attributed to the collaborative practices and meaningful digital pedagogy. Figure 4 represents the summary of the findings based on the phenomenographic analysis process.
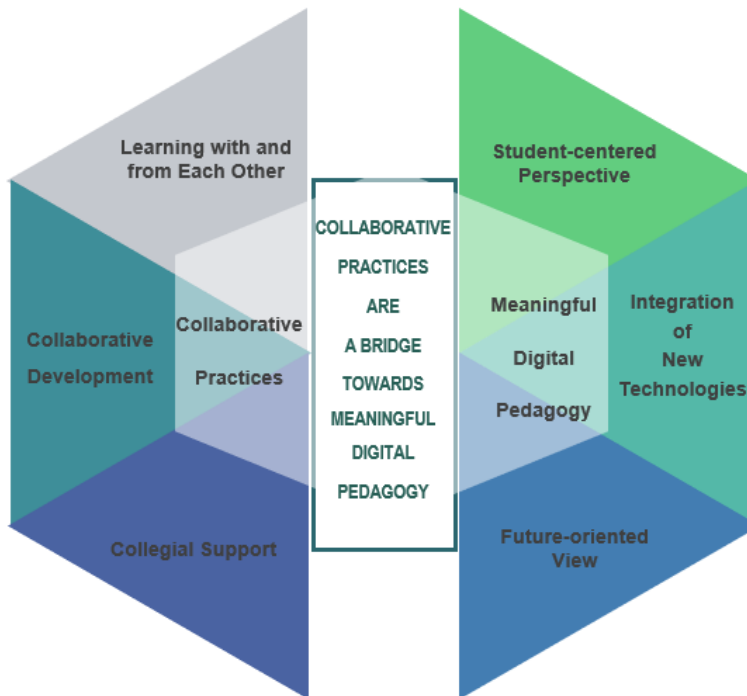
Figure 4 Findings from research questions 1 and 2 in Sub-Study III (Väätäjä & Korte 2023, pp. 144)

Firstly, regarding the first research question: *what meanings do participants attribute to the collaborative practices in the teacher education practicum?* in Sub-Study III it was revealed that the members of the learning community may attribute various meanings to the collaborative practices within the context of a teacher education practicum.

The most common meaning for the collaborative practices within a teacher education practicum was named a context for *learning with and from each other*. The participants mentioned that having reflective conversations helped them to look inward and learn from their experiences, which promotes professional growth. They mentioned that participating in collaborative reflection supported their mutual learning and helped them identify ways to enhance well-being and job satisfaction. In addition, they mentioned that this collaborative practice increased their confidence regarding their teaching methods. The findings suggest that all of the participants saw teacher education as a context for learning with and from each other. The second most common meaning for the collaborative practices within a teacher education practicum was a context for *collaborative development*. In this dissertation, I use the term co-development as a shorter equivalent of collaborative development. The participants sharing this view mentioned that the teacher education practicum

provides a context for the implementation of new ideas into practice which may lead to the co-development of meaningful digital pedagogy. It was also mentioned that the collaborative practices between university teacher educators, in-service teachers and pre-service teachers could support research-based decision-making ensuring that choices were informed by evidence while aiming to change the pre-existing teaching practices. There were 11 participants who provided references from the data sharing the view according to which practicum works as a context for co-development. The third most common meaning for the collaborative practices within the studied teacher education practicums was a context for *collegial support*. According to those who shared this view, the practicum should provide a place for teacher educators, pre-service teachers, and in-service teachers to respect and acknowledge each individual's expertise but also let them find ways to support each other in their field of work. This mutual respect formed the basis for collaborative practices. Additionally, they mentioned that collegial support may engage them in active participation in broader educational dialogues, such as discussions on teachers' professional identity development. There were eight participants who provided references regarding this view, which means that half of the participants shared the view that practicum works as a context for collegial support.

The second research question of Sub-Study III was: *what are the participants' conceptions of meaningful digital pedagogy in the context of a teacher education practicum?* The results of Sub-Study III revealed that meaningful digital pedagogy can be approached from the following perspectives: *a student-centered view*, *a future-oriented view,* and *via the integration of new technologies*, which showcase the diversity of perspectives on meaningful digital pedagogy and its varied implications for teaching practices, student learning experiences, and overall educational goals when digital technologies are implemented. Firstly, the most common perspective was *the student-centered view* of meaningful digital pedagogy, which involved considering students' preferences and prior knowledge when selecting digital technologies. The use of digital technologies as a part of teaching was seen as a means to support collaborative learning and personalize student learning experiences. It also included a view of using familiar digital tools flexibly in various situations reducing the need for extensive teaching the use of new technologies. This perspective aims to address situations where each teacher in a school uses their own digital tools, even though these tools could be integrated into the teaching practices of multiple teachers. The findings suggest that all of the participants conceptualized meaningful digital pedagogy as a student-centered perspective to teaching in the context of a teacher education practicum.

The second most common perspective on meaningful digital pedagogy was *the future-oriented view* which was understood as preparing students for the future by equipping them with essential digital skills. This view emphasized the significance of familiarizing students with diverse digital technologies that are commonly

utilized in the workforce. The focus was on supporting students' employability and adaptability in a rapidly evolving technological environment. This approach also avoided establishing a division between teacher-centered and student-centered approaches, instead striving for the integration of both. There were 12 participants who provided references from the data conceptualizing meaningful digital pedagogy as a future-oriented view of teaching in the context of a teacher education practicum. *The integration of new technologies* was the third most common perspective on meaningful digital pedagogy, emphasizing their role in existing teaching practices without necessarily driving pedagogical change. This perspective involved integrating digital technologies into teaching in a balanced way and they were not seen as a requirement in every lesson. This perspective recognizes that digital technologies can be part of pre-existing teaching practices but also assist in tasks not necessarily related to students' learning such as being a tool for communication between school and home. There were eight participants who provided references from the data conceptualizing meaningful digital pedagogy as the integration of new technologies in the context of a teacher education practicum.

Sin (2010) stated that phenomenographic research is criticized, particularly regarding its data collection methods, because researchers are expected to create concepts from interviewees' statements and interpret them. These interpretations of words can lead to significant differences in research outcomes. This issue is related to the validity of the research, which refers to the internal consistency of the aim of the study, collected data, and results. Additionally, the interviewees' ability to articulate their thoughts affects the content of the research data. The interviewees may also use linguistic expressions that may have different meanings for themselves and the researcher. (Sin, 2010.) Thus, it is vital to identify internal relationships from an individual's own perspective to truly understand the underlying meaning (Johansson et al., 2006). This study followed Johansson et al.'s (2006) suggestion that in an interview, the conceptual meaning of an expression could be clarified by encouraging the interviewee to contemplate the kind of significance they associate with the expression. In practice, this was done by asking follow-up questions and encouraging interviewees to elaborate on their responses to capture more precise meanings. Additionally, the preliminary results from the analysis were shared and discussed with the second author to help validate the understanding and interpretation of the data to improve the credibility of the research. Furthermore, in phenomenographic research generalizability and transferability are often discussed as they typically refer to the extent to which results obtained from a specific sample represent the target population (Sin, 2010). Sin (2010) advises that if the transferability of the findings is the motivation, it could be achieved by offering sufficient information about the context—teacher education practicum—and providing considerations about the other potential contexts—teacher education programs—where the results could be applicable.

5   THE CO-DEVELOPMENT PROCESS OF MEANINGFUL DIGITAL PEDAGOGY

The research presents a process for implementing a learning community approach to co-develop meaningful digital pedagogy within the context of a teacher education practicum. It offers means for the implementation of a learning community approach, emphasizing its potential for the co-development of meaningful digital pedagogy by the in-service teachers, pre-service teachers, and university teacher educators through the meaningful integration of digital tools and technologies. Table 11 summarizes the results from each sub-study that contribute to the process design of co-development of meaningful digital pedagogy.

Table 11 Contributions of the sub-studies to the process design of co-development of meaningful digital pedagogy

	Sub-Study I	Sub-Study II	Sub-Study III
Establishing a learning community		• curriculum development	Set purpose: • learning with and from each other • co-development • collegial support
Conceptualizing meaningful digital pedagogy	Dimensions of digital pedagogy: • orientation • practice • competence	Skills needed for technology integration: • technological skills • pedagogical skills • content knowledge • contextual knowledge	Conceptions of meaningful digital pedagogy: • student-centered view • future-oriented view • technology-focused view
Co-development of meaningful digital pedagogy		Practices for co-development: • negotiating goal(s) • addressing challenges • regular and intentional interaction • leveraging individual's expertise • equal and active participation	Guiding principles: • thoughtful implementation • research-based decision making • supportive environment

The results of Sub-Studies II and III contribute to phase 1 which focuses on establishing a learning community. All of the sub-studies contribute to phase 2 where meaningful digital pedagogy is conceptualized. Furthermore, the results of Sub-Studies II and III contribute to phase 3 which involves the co-development of meaningful digital pedagogy. Figure 5 compiles the results to illustrate the co-development process of meaningful digital pedagogy through these three primary phases.
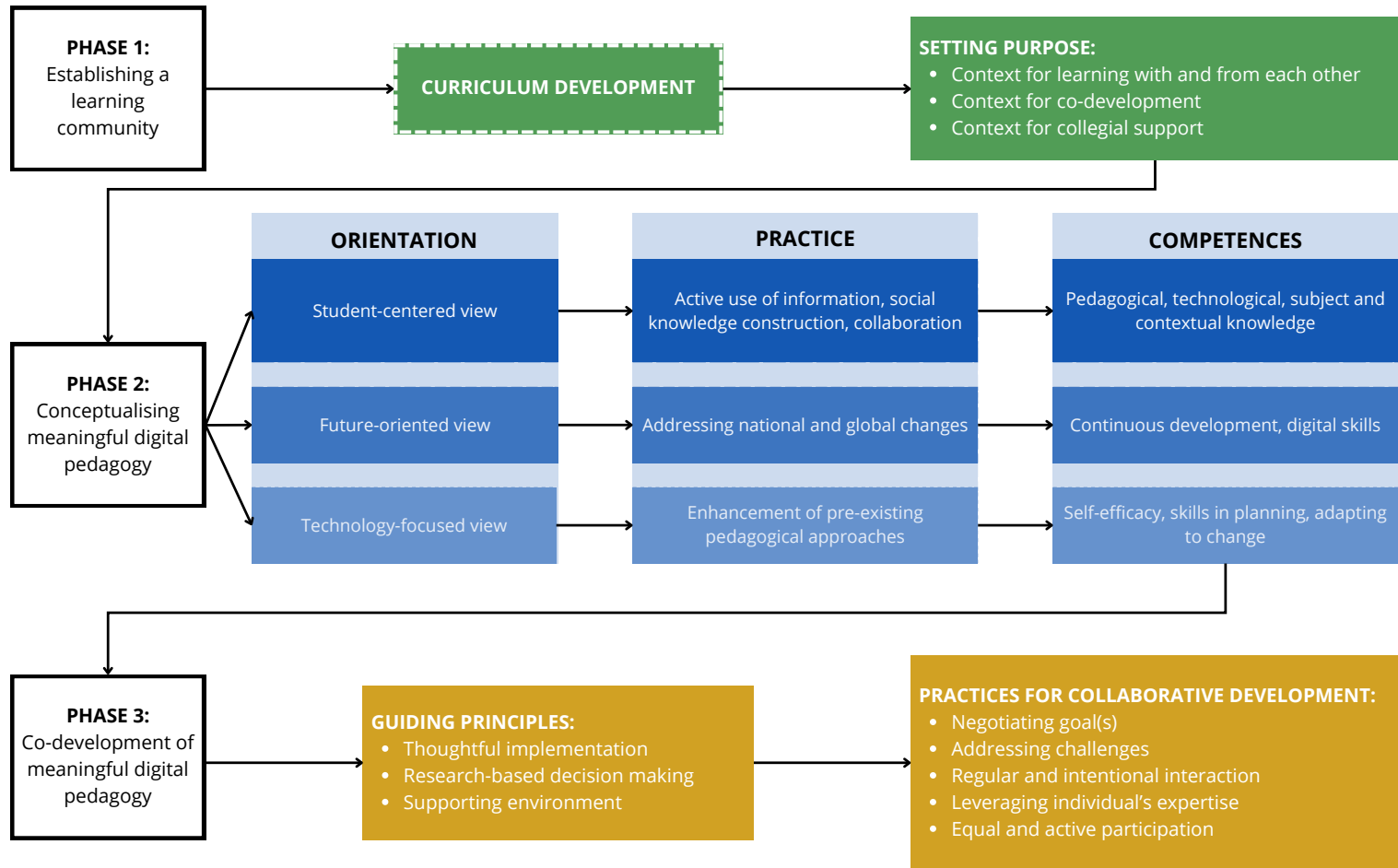
Figure 5 Co-development process of meaningful digital pedagogy

Figure 5 presents the co-development process of meaningful digital pedagogy, and it consists of three separate phases: 1) establishing a learning community, 2) conceptualizing meaningful digital pedagogy, and 3) the co-development of meaningful digital pedagogy. The presented learning community approach has been implemented in the context of a teacher education practicum, but it can provide means to be implemented in other contexts as well. The phases presented in Figure 5 are presented in more detail in the following sub-sections.

5.1   Phase 1: Establishing a learning community

This phase introduces an idea of how to implement a learning community approach in a teacher education practicum. This phase aims to build a foundation for an environment supporting co-development in the form of a learning community. This objective is well in line with the idea of professional engagement in the DigCompEdu framework, which encourages teachers to engage in organizational communication and professional collaboration (cf. Redecker, 2017). Before starting the co-development process, it is crucial that all the involved actors—teacher educators, pre-service teachers, and mentor in-service teachers—know they are part of the learning community and have all the necessary information on how to take part in the process and what is expected of them (Wenger, 1998). Thus, everything begins by forming the learning community and defining its main purpose, which in this study was the co-development of meaningful digital pedagogy. Building and maintaining a learning community requires time, effort, and resources.

In Sub-Study III it was revealed that the members of the learning community may attribute various meanings to the collaborative practices within the context of a teacher education practicum. Collaborative practices in this study are actions that are meant to support the co-development process within the learning community. Firstly, the most widely embraced view was that collaborative practices within a learning community should provide means for *learning with and from each other*. The second most common view was *co-development*, which could be accomplished through these practices among members. Finally, the third view highlighted the role of these practices in providing *collegial support* within the learning community. This reveals the need for holding a discussion on the meaning of the learning community for its members (Wenger, 1998). The study suggests that all the different views could be considered in a teacher education practicum because they do not contradict each other. Thus, this study proposes that the potential of the teacher education practicum for all the involved members, both for schools and university, should be re-discussed when establishing the learning community approach to the practicum. This study also points out that if the meanings for the collaborative practices presented in Sub-Study III were to be implemented there would be a need

to discuss the practices supporting them. This refers to Wenger's (1998) statement that the involved actors should know how to contribute and participate in the established community. Thus, this study suggests that for the teacher education practicum to work as a context for *learning with and from each other*, a context for *co-development* and a context for *collegial support*, it may be achieved by responding to the following questions:

- How to maintain the learning community?
- What should the actors involved do during practicum to *learn with and from each other*?
- What should the involved actors do to achieve *co-development*?
- What should the involved actors do to gain *collegial support* from each other?

Firstly, in Sub-Study II, it was noticed that there is a need to coordinate the implementation of the learning community approach to the practicum by involving the actors from the schools and university (cf. Warner & Hallman, 2017). The university's teacher education curriculum could have a steering role for the learning community, providing clear objectives and expectations for all its members. *Curriculum development* is visualized in Figure 5 with the dashed line as one part of establishing a learning community. This is to highlight that changes in the curriculum are not crucial when establishing a learning community in the practicum but rather could help to maintain the learning community throughout the practicum periods. As it was noticed in the Sub-Study II that co-development can occur during practicum periods even if it not present in the instructional documents such course description within the curriculum or in instructions for mentor in-service teacher. The curriculum can however serve also as a guide that presents practices that support the co-development within the learning community. This could become beneficial especially in cases where the members of the learning community struggle to identify goals or plan collaborative practices (cf. Mindich & Lieberman, 2012).

Secondly, in Sub-Study III it was noticed that *learning with and from each other* happens through reflective conversations, and that focusing on strengths, areas for improvement, and impactful learning moments during practicum periods would be a beneficial practice (cf. Harmes et al., 2016; Næsheim-Bjørkvik et al., 2019). Furthermore, in Sub-Study III, in-service teachers highlighted their participation in a variety of educational projects and collaboration with peers. Combining these ongoing educational projects at school with the teacher education practicums could enhance the learning experience for all the actors involved and strengthen the learning community as a whole (cf. Akiba & Liang, 2016; Pan & Cheng, 2023). These results are in line with research by Pappa et al. (2024) who found that pre-service teachers and in-service teachers acknowledged the need for establishing collaborative environments where they can share knowledge and learn from each

other's experiences. This idea of collaborative environments is supported by the ideas of Tiainen et al. (2018), who argue that practicums should be arranged to support learning in teams.

Thirdly, in Sub-Study III the *co-development* encompassed engaging in discussions on various aspects of teaching, such as evaluations, well-being, parental engagement, and the wider duties associated with being an educator. This stresses the importance of achieving real changes and improvements in teaching methods and research-based decision-making while pursuing professional development. It is noteworthy that the practices related to co-development underlined the significance of having the opportunity and time to experiment and enhance classroom activities from these experiences (Doğan & Adams, 2018; Heikonen et al., 2017). White and Forgasz (2017) noticed in their research that pre-service teachers consistently express the importance of practical teaching experience and the time spent in schools during their initial teacher education.

Fourthly, Sub-Study III found that *collegial support* could be achieved through individual members' actions in terms of creating an atmosphere where everybody feels welcome and equal. Those aligning with this mindset view practicum periods as opportunities for peer support, embracing individuals from various backgrounds (Wenger, 1998). These sessions serve as a platform for discussing the challenges educators face when engaging in public debates and shaping educational policies. Participants also talked about the difficulties that teachers may have in freely expressing their opinions, even though they want to share their knowledge and experiences in the broader conversation about education (cf. Pan and Cheng, 2023). Næsheim-Bjørkvik et al. (2019) also note that well-structured practicum experiences may help the involved actors develop valuable networks involving colleagues from the field of education.

Including these discussions in the teacher education practicum's course description and other instructional documents would encourage the involved pre-service teachers, in-service teachers, and university teacher educators to equalize their roles towards each other (cf. Graves, 1992). Thus, there is a need to discuss what kinds of roles each of the actors have currently and what those roles should be in order to support the involved actors' collaboration. For instance, in Finnish teacher education, in-service teachers are expected to fulfill two roles during a practicum: that of a mentor and that of a teacher (cf. Blomberg, 2014; Puroila et al., 2021). When implementing the learning community approach, one can take on the role of a co-developer. It is also beneficial to understand that the learning community in the context of teacher education practicum crosses organizational boundaries as it involves actors from both the school and university organizations. This is important to note because school-related development projects tend to be contextual (cf. Midtsundstad & Langfeldt, 2020). It can be hard to find a time that works for everyone because members within different organizations may have

different working schedules. Establishing trust among members is essential for the success of any learning community. Building trust takes time, effort, and patience, and it can be difficult to do when members are not physically present at the same time (Tuhkala, 2019). Heterogeneity in the skills and abilities of the learning community provides opportunities for each individual to contribute in a different way toward the common goals. However, as highlighted in Sub-Study II, fostering universal engagement and contributions within this framework is challenging as the members are working in different organisations but also in different positions (cf. Jaspers et al., 2014). According to Wenger (1998), this is a common challenge that could be tackled by including a renegotiation of the common goals and a discussion on how the learning community members may engage more efficiently.

5.2   Phase 2: Conceptualizing meaningful digital pedagogy

This section introduces phase 2, which is about conceptualizing meaningful digital pedagogy based on the results of Sub-Studies I–III. The objective of this phase is to develop a shared understanding and approach towards meaningful digital pedagogy. According to Sub-Studies I, II and III, the conceptualization of meaningful digital pedagogy is not an easy task. The conceptualization of meaningful digital pedagogy presented in Table 10 aims to provide ideas for teachers planning the implementation of digital technologies as a part of their teaching practices but also for curriculum development.

Sub-Study I revealed that digital pedagogy comprises three different dimensions which are 1) pedagogical orientation, 2) pedagogical practices and 3) digital pedagogical competences. *Pedagogical orientation* refers to teachers' perceptions of effective teaching and learning methods and strategies. Sub-Study I revealed that a social constructivist approach to learning emphasizes collaboration, student-centered activities, and active student participation, viewing technology as a cognitive tool to support learning. It was also revealed that teachers may sometimes adopt a so-called traditional approach, which on the other hand, is more teacher-centered, using technology to support teacher-led activities (Adam, 2017). *Pedagogical practices* are the methods teachers use to teach. Some methods may be utilized more easily with digital technologies. Thus, digital pedagogy goes beyond just using technology; it involves creating a learning environment where students engage in problem-based exercises and collaborative learning (Gillett-Swan & Sargeant, 2017; Pittman & Gaines, 2015; Sailin & Mahmor, 2018). *Digital pedagogical competencies* are the skills and competencies teachers need to integrate digital technologies successfully into teaching. This includes not only technical skills but also attitudes, self-efficacy, and contextual knowledge—the ability to adapt teaching methods to implement digital technologies effectively (Brianza et al., 2024; Mannila et al., 2018). The systematic

literature review of Sub-Study I provided some interesting information about how the digital pedagogical process could be seen according to the topical literature. This process however lacked a perspective on what makes digital pedagogy meaningful. Thus, this study suggests that conceptualizing meaningful digital pedagogy may be achieved by responding to the following questions:

- What is the purpose of the implementation of digital technologies in teaching?
- What happens in practice when digital technologies are utilized?
- What kinds of competencies are required from the teacher?

Sub-Study III revealed that the meaningfulness of digital pedagogy can be approached from three perspectives: a *student-centered view*, a *future-oriented view* and a *technology-focused view*. These perspectives showcase the diversity of perspectives on meaningful digital pedagogy and its varied implications for teaching practices, student learning experiences, and overall educational goals when digital technologies are implemented. In this dissertation they are integrated in the presented dimensions—orientation, practices and competences—based on the results of Sub-Study I. However, the different perspectives are the most visible in the orientation phase where the general understanding, premises, and propositions regarding teaching and learning should already be discussed (Tondeur et al., 2017). *The student-centered view* in the orientation phase focuses on personalizing the teaching to meet students' needs and using digital technologies to improve engagement and collaboration. This view also emphasizes the flexible use of familiar technologies to minimize the need for training on new tools. This view aligns with the ideas of Jonassen (1996), by emphasizing the importance of technology-enabled learning and pedagogy that supports it, rather than just integrating technology for the sake of it. This approach should help to tackle situations where each teacher in a school independently uses their own digital technologies, even though these tools could be collectively integrated into the teaching methods of various teachers (Väätäjä & Frangou, 2021). The student-centered view is in line with the findings from Sub-Study I as it also involves the idea of teachers as facilitators and students' taking responsibility for their own learning (cf. Säljö, 2010). This idea is close to the TIM frameworks infusion and transformation levels of technology integration. At these levels, technological tools are frequently utilized to support advanced learning activities or the creation of learning environments that might be challenging or impossible to achieve without technology (Harmes et al., 2016). In Sub-Study II, there were references to self-efficacy which was seen as a beneficial factor supporting teachers taking a student-centered approach while utilizing digital technologies as a part of teaching practices (cf. Mannila et al., 2018; Scherer et al. 2019; Scherer et al., 2018).

The *future-oriented view* in the orientation phase consists of preparing students for the future by equipping them with essential digital skills. This means familiarizing students with digital technologies used in the workforce to improve their employability and adaptability to a changing society. This view may work both in teacher-centered and student-centered teaching activities (cf. Adam, 2017). The *future-oriented view* draws close to the DigCompEdu framework as it takes into consideration transversal competencies such as information and media literacy, which are not considered as subject matter (Redecker, 2017). In a sense, it is also related to the TIM framework's idea of transformation level of technology integration as it emphasizes the integration of technologies in unconventional ways, making them a seamless, almost invisible component of the learning process (Harmes et al., 2016.)

The *technology-focused view* emphasizes modern technologies as an integral part of conventional teaching practices. The *technology-focused view* is based on the term *the integration of new technologies*, which was used earlier in the Sub-Study III (see chapter 4.3.3). This means that the technologies are not necessarily used to achieve any pedagogical change but rather support the existing practices, such as the delivery of instructions (cf. Hinostroza et al., 2016). This view within the orientation phase acknowledges that while digital technologies can enhance pre-existing teaching practices, they can also be used in activities beyond direct student learning, such as enabling communication between the school and home (cf. Harmes et al., 2016). Therefore, this view does not necessarily emphasize a social constructivist approach to the learning process. Instead, it focuses on the practical advantages of integrating technology rather than on pedagogical theories. This view aligns with Adam's (2017) argument that using digital technologies in teaching should not automatically be labeled as a constructivist approach to learning. Sub-Study II revealed that the use of technologies in various teaching and learning settings requires pedagogical skills but also content and technological knowledge from the teacher to be able to determine effective teaching practices to deliver the content (cf. Mishra & Koehler, 2006).

Sub-Study III revealed that the distinct ways of conceptualizing meaningful digital pedagogy highlight the impact they may have on teaching methods and overarching educational objectives. This finding draws close to the Technology Acceptance Model (TAM), which emphasizes the importance of perceived usefulness and ease of use in fostering positive attitudes toward digital tools among educators (Davis, 1989). Juuti et al. (2022) discovered that Finnish teachers recognize the benefits of digital technologies but are cautious about integrating them. They aim to avoid excessive reliance on technology and prioritize creating valuable learning experiences. Furthermore, the study underscored that the quality of digital technology integration, rather than the frequency of use, plays a crucial role in determining its impact on learning outcomes (Juuti et al., 2022). The same idea is reflected in DigCompEdu, which emphasizes the identification, evaluation, and

selection of digital technologies and resources (cf. Redecker, 2017). The diversity of perspectives on meaningful digital pedagogy is implemented in the process because they provide a profound meaning and purpose for digital pedagogy. A combination of different perspectives can be covered throughout the learning process.

5.3 Phase 3: Co-development of meaningful digital pedagogy

This section introduces phase 3 involved in the co-development process of meaningful digital pedagogy based on the results from Sub-Studies II and III. The objective of phase 3 is to collaboratively develop meaningful digital pedagogy. The co-development of meaningful digital pedagogy begins after the learning community is established (see phase 1) and meaningful digital pedagogy is conceptualized (see phase 2). In Sub-Study II, it was found that the following practices may help to organize the co-development process: 1) negotiating goal(s), 2) addressing challenges, 3) regular and intentional interaction, 4) leveraging individual expertise, and 5) equal and active participation. The study suggests answering the following questions when discussing the collaborative practices involved in the co-development process of meaningful digital pedagogy:

- What kinds of goals for the co-development of meaningful digital pedagogy are to be set?
- What kinds of challenges may occur?
- How should participants interact regularly and intentionally?
- What areas of expertise can be recognized within the community?
- How can the members contribute towards the common goals?

Defining *negotiated goal(s)* that everyone in the learning community can agree upon is the first step. These goals should be specific, measurable, achievable, relevant, and time-bound (Tinnell et. al., 2019; Wenger, 1998). In Sub-Study II, it was noticed that the goals can be related to finding ways to activate students during lessons or support their collaboration with each other. It is also noteworthy that the actors involved in the co-development process should feel a connection towards the set goals in order to ensure mutual engagement towards them. The negotiated goals guide the development and implementation of meaningful digital pedagogy. This is a critical step in ensuring that the meaningful digital pedagogy being developed aligns with the needs and expectations of all actors involved. As Ertmer and Ottenbreit-Leftwich (2010) state, teachers need to be involved in the visioning process so that they can feel it is their own. Therefore, the negotiated goals should relate to the needs set by teacher educators and pre-service teachers from the university, and mentor in-service teachers from the school (Vangrieken et

al., 2017). The set goals can be related to ongoing research projects such as master's theses or development projects in schools, or even both (cf. Eklund, 2014). It is beneficial to acknowledge the dual role of technologies in the field of teacher education: 1) technologies as a means to improve the quality of learning content for the pre-service teachers, and 2) technologies as a means to prepare pre-service teachers to support digital transformation of the schools (cf. Consoli et al., 2023; Kaminskienė et al., 2022; Wohlfart & Wagner, 2023). The negotiated goals within the context of a practicum can be focused on either one of them as long as they support the engagement of the school community. It is however noteworthy that the pre-service teacher alone should not work as a driver for the digital transformation of the school culture, but the responsibility should be distributed also amongst the in-service teachers and teacher educators. Well-defined goals provide a solid foundation for designing educational strategies and assessing their effectiveness (Wenger, 1998).

It is beneficial to *address challenges* that may hinder the achievement of the negotiated goals when developing an action plan that outlines the steps needed to achieve the goals (Wenger, 1998). The actors should be able to address potential challenges throughout the co-development process, not only at the beginning. These challenges can be multifaceted, including technological issues, such as access to devices and reliable Internet connections; pedagogical concerns such as adapting teaching strategies to engage students in a digital environment; and systemic obstacles, including institutional resistance to change or lack of support (McCarthy et al., 2017). By acknowledging issues early on and considering them within their specific environment, the members can plan how to overcome them (Ertmer & Ottenbreit-Leftwich, 2010). In Sub-Study II, a notable challenge addressed was the concern that the considerable amount of time devoted to teaching students how to use different technologies might take too much time away from actual learning activities.

Regular and intentional interaction is essential for a learning community to function properly because it is needed to evaluate the progress toward the common goal and make changes to the action plan if needed (Wenger, 1998). Wenger (1998) posits that mutual engagement—a cornerstone of effective collaboration—necessitates the opportunity for members to work closely together. It was noticed in Sub-Study II that this interaction came naturally between pre-service teachers and their in-service teacher mentors through the face-to-face meetings at the school during the practicum. Meanwhile, teacher educators often participated in the process remotely, contributing through feedback or action proposals (cf. Tuhkala, 2019). Both face-to-face and remote interactions can be helpful as long as there are clear ways for members to communicate. Remote interactions using digital communication tools offer flexibility, accessibility, and the potential to connect members without geographical limitations.

Leveraging individual expertise is beneficial for the learning community because when the set practices work, a diverse membership can bring different perspectives and experiences to the table (Wenger, 1998). In Sub-Study II, it was noticed that within the context of a practicum the collaboration between the involved actors highlighted how pre-service teachers' technological and pedagogical knowledge and in-service teachers' deep understanding of subject matter and school practices complemented each other (cf. Maslin & Smith, 2017). The teacher educators' role would be in providing a conceptual framework for the topic at hand, for example digital pedagogy and then together explore ways to implement and support these concepts within basic education. This provided possibilities for contributing to the co-development process and the achievement of shared goals.

Equal and active participation is needed from all the members and they are essential for a learning community (Wenger, 1998). This is because co-development requires time to reflect on the process and evaluate the outcome (cf. Jaspers et al., 2014). In the context of a practicum, it is beneficial to acknowledge that equal and active participation may be complicated by power relations between pre-service teachers and more experienced members of the school community (cf. Heikkinen et al., 2012). Thus, this study is supported by the findings by Korhonen et al. (2017), who noticed that epistemological equality supports participation because diverse knowledge and perspectives are seen as equally valuable. There should be practical ways for the members to participate in the learning community to share knowledge, for example regarding teaching strategies, and innovative ideas with each other (Danaher et al., 2009). This participation and community involvement should be seen as a part of teacher education.

The introduced process for the co-development of meaningful digital pedagogy is meant to provide support setting the shared practices for the members of the learning community within the context of a teacher education practicum.

6. DISCUSSION AND CONCLUSION

6.1 Discussion of the co-development process of meaningful digital pedagogy

The process introduced in this dissertation provides a way to bring educators from the university and school together to co-develop meaningful digital pedagogy in basic education—an attempt to bridge the latest research with practical application in school settings. In the teacher education practicums that provided the context for this study, a learning community approach was implemented to support the members' collaborative practices and learning from each other. This approach to professional development is not completely new. Cifuentes et al. (2011) established a learning community to support technology integration within three rural schools in Texas, USA and found it effective in supporting teacher professional development. They, however, emphasized the need for a better understanding of how to create and sustain learning communities within schools (Cifuentes et al., 2011). The results of this dissertation suggest that implementing a learning community approach in teacher education practicums could help ensure their sustainability as an integral part of teacher education curriculums. It is however noteworthy that the learning community in this study is not constant but is restricted by the timeframe of the teacher education practicum period. Additionally, pre-service teachers are no longer members of the learning community after completing the practicum. Teacher educators and in-service teacher mentors, however, remain the same in future practicums as well.

Other challenges, however, were identified in this dissertation. One such challenge is that as teacher education practicums are traditionally integral to the teacher education curriculum, they primarily emphasize the learning objectives designated for pre-service teachers, often overlooking the roles of in-service teachers and university teacher educators. The learning community approach challenges the idea that teacher education practicums are merely understood as courses aiming to provide an environment for only the pre-service teachers to learn from experienced teachers, observe their teaching practices, and receive feedback on their own teaching (Resch et al., 2022). In Sub-Study II, it was noticed that the practicum's course description and instructional documents did not support co-development between pre-service teachers, in-service teachers, and university teacher educators. The instructional documents mainly focused on the pre-service teachers' learning objectives and tasks set for the mentor in-service teacher. While the main focus of

teacher education practicums often centers on the learning of pre-service teachers, it would be equally important to consider the value they have for university teacher educators and in-service teachers as well. However, this does not imply that we should ignore the learning objectives set for pre-service teachers. On the contrary, the learning community approach should still be implemented in a manner that the learning objectives set for the pre-service teacher are achieved. This issue also raises a need to reflect whether a learning community approach implemented in a teacher education practicum can truly foster social construction of knowledge among all of its members, or is it merely more about exchanging information.

This dissertation also contributes to the discussion on using the teacher education practicums as a developmental environment for meaningful digital pedagogy in basic education. It introduces a process design that positions the practicum as a context that supports both new and experienced teachers to experiment, learn, and contribute to the development of meaningful digital pedagogy in basic education. This includes understanding how to use digital technology as a pedagogical tool, how to incorporate it into lesson plans, and how to guide students in using technology responsibly and effectively. It also helps educators in discussing the profound purpose that digital technologies serve as a part of teaching practices. Furthermore, it is important to mention that this research was carried out at the start of the COVID-19 pandemic. This timing made the investigation of the co-development of meaningful digital pedagogy relevant, as both universities and primary schools had to shift from contact teaching to distance teaching. Had the research been conducted a year earlier, the results might have been different. This is largely due to the fact that many educators were compelled to adopt new teaching practices in response to the pandemic. By the time data was collected for this study, a number of teachers had already gained some experience—both positive and negative—with the integration of digital technologies into their teaching practices.

6.2   Methodological evaluation

This section includes the methodological evaluation of the dissertation. Since this study employs a qualitative multi-method approach, the evaluation follows the criteria for qualitative research established by Lincoln and Guba (1985), specifically focusing on *credibility*, *transferability*, *confirmability*, and *dependability*. Additionally, Denzin's (1978) concept of triangulation is used to further assess the research. Firstly, credibility refers to confidence in the accuracy of the data and interpretations (Lincoln & Guba, 1985). The dissertation consists of one theoretical sub-study and two empirical sub-studies. The theoretical sub-study (Sub-Study I) is a systematic literature review, while the empirical sub-studies include a case study (Sub-Study II) and phenomenographic research (Sub-Study III). In this dissertation, most of the

research data was collected through individual interviews (Sub-Study II) and group interviews (Sub-Study III). Additionally, data was gathered through the systematic literature review (Sub-Study I) and by observing instructional documents from the teacher education practicum (Sub-Study II). Considering methodological triangulation, this dissertation used multiple methodologies and approaches because it involved varying research objectives.

Mishler (1991) suggests that when using interview data, researchers may face theoretical and methodological challenges due to language and meaning. However, Hammersley (2003) notes that the challenges associated with using interview data can be managed if researchers are conscious of the potential issues and exercise caution when interpreting and drawing conclusions from the data. Sin (2010) suggested several practical considerations for conducting interviews to reduce the influence of the interviewer, which were followed. Firstly, in the present research there I made an attempt to create an open and respectful atmosphere during interview situations as they involved participants looking at the phenomenon from different perspectives. Secondly, I tried to communicate clearly by asking follow-up questions to ensure I understood the interviewees' answers. Thirdly, I avoided using unfamiliar terms or correcting the interviewees, and I gave them enough time to provide thoughtful responses. Fourthly, I tried to keep a neutral facial expression throughout the interviews to prevent influencing the interviewees' responses (Sin, 2010). To enhance credibility and researcher triangulation, the co-authors of the articles derived from Sub-Studies I and III were involved in the interpretation of the results based on the analysis processes (Denzin, 1978; Morse, 2018). A limitation regarding Sub-Study II is that there were no other researchers involved in the analysis process. All of Sub-Studies I–III included practical examples of the data analysis process to demonstrate to the reader how the data interpretation was approached. This was beneficial because it provided an internal peer review process regarding the data analysis which helped to ensure that findings and interpretations are robust and well-validated.

Secondly, transferability by Lincoln and Guba (1985) is about the extent to which the findings can be applied in other contexts or with other groups. While the transferability cannot be ensured, detailed descriptions of the research context and participants can be provided, allowing readers to make connections to their own contexts (Lincoln & Guba, 1985). This is a challenge in this research as the context were the teacher education practicums of a single Finnish university. It cannot be promised that the approach could be implemented in all teacher education practicums elsewhere. The learning community approach's implementation work should include reform in the instructional documents of the practicum provided for the university teacher educators, pre-service teachers, and mentor in-service teachers, but they should also be considered in the curriculum development. There was an attempt to make a detailed description, including the setting, demographic

details, and why participants were chosen, providing sufficient information for others to evaluate the applicability of the findings to new settings.

Thirdly, confirmability by Lincoln and Guba (1985) refers to the degree to which the findings are shaped by the respondents and not researcher bias, motivation, or interest. Recognizing their own biases and perspectives enables researchers to conduct more objective and reflective analyses, ensuring that the research outcomes are reliable and contribute meaningfully to the field of the study (Lincoln & Guba, 1985). Confirmability is related to axiology which is the philosophical study of value (Guba & Lincoln, 1994; Jennings, 2010). Axiology in the social constructivist paradigm emphasizes the importance of values, ethics, and biases in the research process. Thus, researchers are expected to reflect on their values, ethics, and biases to identify how they may influence their interpretations and interactions with participants (Jennings, 2010). Sin (2010) argues that researchers should recognize their own preconceptions at the start of the research and then continuously consider how to minimize these biases at each stage of the research process. This also involves assessing whether these biases have been sufficiently addressed throughout the study (Sin, 2010). Researchers may have different positions in the research process as some may lead the entire research project, while others may contribute to specific aspects of the research, such as data collection or analysis. Regarding this dissertation, I as the main author of this dissertation led the research projects related to Sub-Studies I–III. My role, however, varied in the different sub-studies because different research methodologies and approaches were used but also as the sub-studies were conducted in different contexts. Sub-Study I was conducted as a systematic literature review with the aim of conceptualizing the dimensions and a model for digital pedagogy. The overall goal was to understand what we talk about when discussing digital pedagogy. The conceptualization offered by Sub-Study I included perspectives of a total of 12 empirical articles. The sample size was the result of strict inclusion and exclusion criteria. The careful selection of articles through defined inclusion and exclusion criteria was paramount to ensuring that the study's outcomes are a true reflection of the research aim—conceptualization of the dimensions and a model for digital pedagogy.

During the time of Sub-Study II, I was working as a coordinator of the guided field practicum at the University of Lapland and as a junior researcher in the OpenDigi project funded by the Finnish Ministry of Education and Culture. During this time, I held discussions with supervisors and co-workers about the research design of Sub-Study II in order to acknowledge biases that could affect the research. The aim was to use the results of Sub-Study II to develop the guided field practicum as a university course, which also provided the context for the study. In the interviews, we also discussed how the guided field practicum could be enhanced. Acknowledging my position helped me to be more cautious not to divert the focus of the research to course development. During Sub-Study III, I was no longer responsible or involved

through my work in any of the teacher education practicums. Sub-Study III was conducted as phenomenographic research, and it aimed to identify variations in the conceptions related to collaborative practices and meaningful digital pedagogy. This aided in examining the teacher education practicums from a new point of view because I no longer possessed the power to change the pre-existing practices but also because the context lay in a guided advanced practicum, which is different from the guided field practicum. Thus, my biases and the ethical implications were reflected separately in each of the sub-studies and not only in the beginning of the research process.

Fourthly, dependability refers to demonstrating that the research findings are consistent and could be repeated. As such dependability is very close to the term reliability, which is more often used in quantitative research (Lincoln & Guba, 1985.) Sin (2010) notes that one could argue that applying the concept of reliability to qualitative research is problematic because of the changing nature of social realities and research settings. Dependability is akin to reliability in quantitative research but acknowledges the changing nature of social realities (Lincoln & Guba, 1985). Sin (2010) argues that dependability in qualitative research can be achieved if researchers thoroughly document and clearly explain their interpretation process, for example, regarding the analysis of the data. This allows readers to evaluate the dependability of the whole research process and its findings (Sin, 2010). Each of the sub-studies included some examples of the data analysis process and direct citations from the research data. It is important to note that the research data was diverse and collected from various sources, including empirical articles, instructional documents from the practicum, university teacher educators, pre-service teachers, and in-service mentor teachers. This diversity enhances the study's reliability through data triangulation (Denzin, 1978). The sub-studies also consist of sections where the methodologies and data used have been described in detail.

6.3   Ethical evaluation

The guideline provided by the Finnish National Board on Research Integrity TENK (2019) were followed throughout the research process pursuing reliability, honesty, respect, and accountability. Moreover, the ethics regarding Sub-Studies I–III have been consistently reviewed and reflected upon throughout the research project, not merely at the end of the process. It is also noteworthy that each of the articles derived from Sub-Studies I, II, and III have gone through a peer review process before being accepted in a scientific journal where ethical questions could have been discussed.

In this study, most of the empirical research data was collected from teacher educators, pre-service teachers, and in-service teachers. The university teacher educators and pre-service teachers were affiliated with the University of Lapland,

while the in-service teachers were employed at various primary schools. For the Sub-Study II, the in-service teachers were based in primary schools located in Lapland. In Sub-Study III, all participating teachers were employed at the Teacher Training School of the University of Lapland. The research permits were obtained individually for each sub-study from the participants' home organizations, namely the University of Lapland and the schools where the teachers were employed, as well as from the participants themselves. In Sub-Studies II and III, the participants were provided with both written and oral overviews of the research project, including detailed information on how their data would be utilized according to TENK (2019) guidelines. Thus, the participants were given a chance to ask clarifying questions. The participants engaged in the research voluntarily, and informed consent was obtained from them. The voice recordings were solely used for conducting this research and it was promised that they would be destroyed upon the completion of the study. The participants were also informed that they had the right to withdraw from the research at any time of their choosing (TENK, 2019). The research data files were all in digital form, consisting of audio recordings and transcribed text files, and they were stored in a OneDrive for Business folder which is provided by the University of Lapland to its personnel. Thus, the research data could be accessed only by me as the first author. According to the General Data Protection Regulation (GDPR), personal data is defined as any information relating to an identified or identifiable natural person. The research data itself did not include any personal or sensitive personal information, as such information was removed from the transcriptions before it was analyzed. However, it is noteworthy that the person speaking in the recordings could be identified if it was combined with some other available information. When reporting the results in Sub-Study II, the specific schools where the practicums took place were not disclosed in order to safeguard the privacy of the participants. This is primarily due to the small size of the schools involved in the study, which could potentially lead to a high risk of identifying the interviewees.

Generative Artificial Intelligence (GenAI), a subset of artificial intelligence, has been employed in this study to assist in translating Finnish texts into English and vice versa. GenAI leverages machine learning algorithms to understand patterns in data and generate new content that mirrors the input data. Regarding the use of GenAI it is important to mention some ethical considerations. Firstly, it is important to understand that AI systems learn from the data they are trained on. If the training data contains biases, the AI system can inadvertently perpetuate or even amplify these biases. Secondly, it can be challenging to understand how GenAI has arrived at its outputs. This lack of transparency, often referred to as the 'black box' problem, can make it difficult to fully trust the AI's results (King & Zenil, 2023b). Therefore, nothing was taken as given by the GenAI. In practice, I utilized GenAI translation-related tasks to gain a better understanding of the articles I read and help me produce better text in English. GenAI cannot be considered an author of

a scientific text, as it is a tool, and authorship always involves responsibility, which GenAI cannot cover. Thus, it is important to note that I am personally responsible for the accuracy of the results presented, and GenAI did not produce any content for this study. GenAI tools are evolving; academics should learn more about GenAI technologies and stay abreast of potentially useful ways to make use of them in various research stages. (King & Zenil, 2023a.) Despite the progress in GenAI, it is still crucial for humans to oversee and make important decisions, especially in high-stakes situations (UNESCO, 2022).

To conclude, the good practices of the scientific community have been followed throughout this research, aiming for honesty, caution, and transparency. The research provides detailed documentation of methodologies, data analysis, and ethical considerations to demonstrate honesty and transparency.

6.4   Implications and future direction

Teaching and learning science, known as pedagogy, is the basis of education. The advancements in digital technologies challenge educators to integrate them in pedagogically meaningful ways. The meaningfulness represents more than just adding new digital technologies as a part of one's teaching practices; it emphasizes that pedagogy needs to remain relevant and impactful. To realize such goals, research conducted in universities should not be disconnected from the actual reality faced in schools. The development of pedagogy should be a collaborative process involving the teacher educators conducting research from the university with the in-service teachers from schools who consistently develop their teaching practice. This dissertation reveals that establishing a learning community can be a suitable approach for bringing actors from different organizations—universities and schools—together and providing them with contexts for learning with and from each other, co-development, and collegial support. The teacher education practicums provided the context where the pre-service teachers, university teacher educators and in-service teachers could together as educators experiment with and reflect on the use of digital technologies in their teaching. The learning community approach also made finding new information about conceptualizing meaningful digital pedagogy possible. In these kinds of contexts, pedagogy can be collaboratively developed and enable the sharing of knowledge. Drawing on more recent frameworks such as TPACK (Mishra & Koehler, 2006), DigCompEdu (Redecker, 2017), and the TIM (Harmes et al. 2016), future studies could explore how collaborative processes within learning communities can enhance educators' technological, pedagogical, and content knowledge (cf. Mishra & Koehler, 2006).

To establish a learning community in a teacher education practicum, it is beneficial to understand that there is a need to discuss the significance of the

practicum also from the perspectives of teacher educators and mentor in-service teachers. Generally, teacher educators' and mentor in-service teachers' roles extend beyond being competent teachers of their own subject; they are also expected to facilitate the professional development of pre-service teachers. However, the learning community approach discussed in this dissertation introduces a new perspective. It suggests that these in-service teachers should not only be effective educators and mentors for pre-service teachers during the practicum periods but also continuous learners themselves. Teacher education practicums are part of the teacher education curriculum which means that the focus is very often limited to the pre-service teachers' learning and the tasks required of them. This would need more discussion on the role and significance of the teacher education practicums as a context for collaboration between universities and schools—not only as a mandatory university course for pre-service teachers. These issues could be discussed and solved when developing teacher education practicums and making these changes visible in the teacher education curriculum. Moreover, future research could explore how pre-service teachers' master's thesis topics could be aligned with the negotiated goals of the practicum. However, this requires careful balance, as these goals should also reflect the perspectives of teacher educators and in-service teachers. To be truly collaborative, the negotiation process must ensure that all voices are equally valued. If practicum goals are shaped solely by pre-service teachers' research interests, teacher educators and in-service teachers may feel disengaged, reducing both their involvement and the practicum's overall relevance.

Additionally, the ongoing progress of digital technologies challenges future teachers who must be equipped with the necessary skills to integrate these technologies into their teaching in meaningful ways, enhancing the learning experience in a responsible and ethical manner. It is critical to acknowledge, though, that not every technological innovation requires integration into the classroom. This can include discussions around online safety, privacy, and digital citizenship, as well as promoting social justice and cultural awareness through the use of digital resources. It is also noteworthy that choosing which technologies to integrate is as important as how to integrate them. There is a need to create environments for teachers to support their continuous learning and adapting to new technologies. It is, however, noteworthy that the sub-studies of this dissertation do not specifically cover the views of teacher education or school leaders about the topic and it is focused on making interpretations from an individual teacher educators', pre-service teachers' and in-service teachers' perspectives (cf. sub-studies II & III). Therefore, in the future, it would be interesting to study what kind of role the teacher education and school leaders could have in establishing and maintaining these learning communities. Additionally, it would be beneficial to examine how these groups of teacher educators, pre-service teachers, and in-service teachers construct shared meaning and what differences exist between the groups, including

those from different backgrounds. Expanding this research in this direction could provide valuable insights that could be utilized to support members in establishing a functional learning community. Thus, an important area for further research would be to investigate the role of teacher education and primary school leaders in supporting the co-development of meaningful digital pedagogy within the context of learning communities involved in teacher education practicums.

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APPENDICES

APPENDIX 1. Interview questions (Sub-Study II)

Presentation of the research and informed consent.

Interviewer and the participant present themselves.

Interview begins.

The interviews consist of two parts: 1) practices supporting co-development and 2) co-development of digital pedagogy. The first part includes questions about the practices supporting co-development during the practicum.

1. How would you describe co-development among university teacher educator, pre-service teacher and mentor in-service teacher within the context of practicum?
2. What kinds of goals did you set for the co-development during the practicum?
3. What was your role in the co-development?
4. How would you see others' roles in the co-development?
5. How often did you meet the other stakeholders?
6. How would you evaluate the success of the co-development?

Now we are moving to the second part of the interview. Questions in the second part of the interview are related to the co-development of digital pedagogy.

7. How did you utilise digital technologies during the practicum?
8. How did you end up using these digital technologies?
9. How familiar were you with the chosen digital technologies?
10. How did the implementation of these digital technologies affect pedagogy?
11. What should be the role of digital technologies in the classroom?

Thank you for the interview!

APPENDIX 2. Example for written informed consent (Sub-Study III).

Translation to English by the author

LAPIN YLIOPISTO
UNIVERSITY OF LAPLAND

Harjoittelukoulu
Teacher Training School

Research on Co-development of Meaningful Digital Pedagogy

I am seeking permission for research related to the co-development of meaningful digital peda-
gogy. In my dissertation, I outline a digital pedagogical model to support the use of technologies
in teaching and examine the co-development practices behind digital pedagogy in the context
of primary teacher education practicum.

Currently, I am working on the final sub-study of my dissertation, which aims to identify varia-
tions in the features related to meaningful digital pedagogy. during advanced practicum. The
participants would include teacher educators (N=4), student teachers (N=8), and supervising
classroom teachers (N=4). I would like to organize small group interviews as part of the guidance
discussions conducted by supervising teacher educators. My supervisor, Professor Heli Ru-
okamo, and I have discussed that the advanced practicum provides great ground for conducting
this research.

The relevance of the topic is supported by the applicability of the digital pedagogical model,
especially in planning distance education. Additionally, our faculty has recently started curricu-
lum development work, and this research could contribute to the development of practicum
content.

The research is intended to be conducted in such a way that it does not increase the workload
of any participant beyond attending one small group interview (approximately 30 minutes). The
research data will consist of recordings from these small group interviews. The identity of the
participants will remain confidential and will not be disclosed further. The final research report
will not include any personal or identifiable information. Pupils of the school are not the focus
of this research.

Participation in this research is entirely voluntary, and only willing classroom teachers, univer-
sity lecturers, and their supervised students will be included. Participation in the study is com-
pletely voluntary, and you can withdraw from the study at any time. You can reach me via the
contact details below if you want to know more about the research process. Thank you in ad-
vance for your time!

Janne Väätäjä
Researcher
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APPENDIX 3. Group interview questions (Sub-Study III)

Translation to English by the author

Presentation of the research and informed consent.

Interviewer and the participants present themselves.

Interview begins.

The interviews consist of two parts: 1) collaborative practices and 2) meaningful digital pedagogy. The questions in the first part of the interview are related to the collaborative practices among the university teacher educators, in-service teachers and pre-service teachers in the context of teacher education practicum.

1. What kinds of collaborative practices do you implement in teacher education practicums?

2. How did these collaborative practices support the development of your competence?

3. What is the meaning of these collaborative practices?

4. What other means can you propose for collaboration and enabling learning experiences for all of you?

5. How do you view the teacher education practicum?

Now we are moving to the second part of the interview. The questions related to this part are related to the meaningful use of digital technologies in educational settings.

6. What does digital pedagogy mean to you?

7. What makes digital pedagogy meaningful?

8. What factors make the use of technology in teaching meaningful?

9. How has your digital pedagogical competence developed during the practicum period?

10. How could the teacher education practicum serve as a context for co-developing digital pedagogy?

Thank you for the interview!

ORIGINAL LIST OF PUBLICATIONS

This dissertation is based on the three original article publications, which have been referred to in the text as sub-studies by their Roman numerals I to III.

Sub-Study I

Väätäjä, J., & Ruokamo, H. (2021). Conceptualizing Dimensions and a Model for Digital Pedagogy. *Journal of Pacific Rim Psychology, 15*. https://doi.org/10.1177/1834490921995395

Conceptualizing dimensions and a model for digital pedagogy

Janne Olavi Väätäjä and **Heli Ruokamo**

Abstract

The global COVID-19 pandemic has caused a rising interest in the use of digital pedagogies and the need to teach remotely. This article aims to conceptualize the dimensions described below and offer a model for digital pedagogy to provide tools for using digital technologies in teaching. The model for digital pedagogy is discussed in terms of three dimensions: 1) pedagogical orientation; 2) pedagogical practices; and 3) the digital pedagogical competencies it provides for the teacher. This study examines how the dimensions of digital pedagogy are presented in the current research literature. The research is conducted through a systematic literature review surveying articles published in the years 2014 to 2019; a total of 12 articles are included in the review. The findings suggest that, first, in many cases, pedagogical orientation is labeled as socio-constructivist and student-centered. Second, pedagogical practices are the methods used to promote students' learning; they involve, for example, collaboration and social knowledge construction. Finally, in addition to technological, pedagogical, and content knowledge, teachers' success in blending digital technologies into their teaching is improved by high self-efficacy and strong peer-collaboration skills.

Introduction

The current generation of youth is being educated in a world filled with digital technologies that shape everyday life. Digital technologies have, among other things, created new opportunities to seek and share information more easily. Education systems around the world are adapting to the changes that digital technologies are causing in society and are preparing to meet the new learning expectations of 21st-century pupils (Nehring et al., 2019, pp.5–6). The global COVID-19 pandemic has caused schools to rethink their pedagogical practices because they had to arrange remote teaching. Remote teaching must provide learning experiences of the same quality for pupils as contact teaching. Municipalities and school administrations are also paying attention to these changes when designing and planning in-service training for teachers. Nowadays, the development of new learning expectations for pupils and new digital technologies have necessitated that teachers continuously rethink their pedagogical practices (Sailin & Mahmor, 2018, pp.146–147). This study contributes to the field by summarizing some

theoretical issues and offering a model for effectively integrating digital technologies into teaching.

The aim of the current research is to contribute to a broader understanding of what digital pedagogy really is, beyond the simple use of digital technologies in teaching. First, the study investigates how the dimensions of digital pedagogy are conceptualized in the current literature. This is done by examining its pedagogical orientation, pedagogical practices, and digital pedagogical competencies. Second, this study presents a model based on the dimensions of digital pedagogy. The study then maps the scope and types of recent research and models related to digital pedagogy through a systematic literature review. A systematic literature review was chosen as the research method because it helps to provide an up-to-date

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understanding of the topic at hand (Creswell, 2018, p.25). The existing literature has begun to address digital pedagogy as a concept, but thus far seems to lack detailed studies and surveys that contribute to a broader understanding.

Dimensions of digital pedagogy

Digital pedagogy is a challenging concept to define because it can be examined from many perspectives. Generally, "digital pedagogy" refers to the use of electronic elements to enhance or change the experience of education (Croxal, 2012). Kivunja (2013, p.131) presented a more detailed definition, referring to "digital pedagogy" as the skill of embedding digital technologies into teaching so that they enhance learning, teaching, assessment, and curriculum. Therefore, digital pedagogy can also be considered a pedagogical use of digital technologies. A model of digital pedagogy is introduced in this study that aims to explain the pedagogical use of digital technologies. This model of digital pedagogy comprises three dimensions: 1) pedagogical orientation; 2) pedagogical practices; and 3) digital pedagogical competencies.

The planning of digital pedagogical activities begins by considering the *pedagogical orientation*. Udd (2010, p.47) defines "pedagogical orientation" as a teacher's perceptions of what the learning process should look like, how individuals learn, and how they should be taught and counseled. According to Law (2009, p.313), pedagogical orientation depends on curriculum goals, the teacher's role in relation to teaching practices, and students' roles in relation to learning practices. Tondeur et al.'s (2017) conceptualization of pedagogical beliefs is similar to pedagogical orientation and is defined as the understanding, premises, and propositions regarding teaching and learning. They argued that changes in teachers' pedagogical beliefs may occur when technologies are integrated into teaching (Tondeur et al. 2017).

A traditional pedagogical orientation comprises the predefined learning goals, the teacher's role as an expert and assessor, and the students' role as completing the given closed-ended tasks (Law, 2009, p.317). A constructivist pedagogical orientation emphasizes students' activities in learning and the social and reflective construction of knowledge (Udd, 2010, p.48). A constructivist pedagogical orientation does, however, take the teacher's role into consideration as well. The teacher is seen as a facilitator whose goal is to enhance students' deep understanding of the topic by giving them opportunities to express their conceptions and perceptions (Payne & Reinhart, 2008, p.35). Milton and Vozzo (2013, p.76) argued that digital pedagogy has more in common with the constructivist

approach to teaching than it does with traditional pedagogy, because it concentrates on how students construct their own knowledge. Prestridge (2012, p.449) argued that "digital pedagogy" cannot be considered only as the use of digital technologies within teacher-directed approaches; rather, it also includes practices in which ICT is used to enable learners' collaboration, creation, and active use of information (p.457). Social theories of learning, such as socio-constructivism and social cultural theory, are related to Vygotsky's (1978) ideas in which social factors and culture are emphasized in cognitive development.

Pedagogical orientation may change when digital technologies are integrated into teaching. Butler et al. (2017, p.235) noted in their research that the use of digital technologies in teaching and learning resulted in learners taking more responsibility for their own learning, which increased their collaboration and activity. There was a shift in pedagogical orientation because the use of digital technologies enabled teachers to design learning environments that supported pedagogical practices involving students' collaboration, problem-solving, and knowledge-construction (Butler et al., 2017, pp.235–236).

The term *pedagogical practices* here refers to the methods the teacher uses to teach. Prestridge (2012, p.453) recognized four factors that represent teachers' ICT practices. The first factor is "foundational ICT practices," which refers to teachers' initial thoughts on incorporating ICT into their teaching practices, including understanding that ICT should be integrated into learning areas in schools and planning ways in which to incorporate ICT into their own teaching. However, teachers in this first phase do not have a deep understanding of how ICT enhances learning. The second factor is "developing ICT practices," which means that teachers are starting to understand the curricular implications of ICT. In the third factor, "skill-based ICT practices," teachers focus on ICT skills rather than the use of ICT to enhance learning. The fourth and last factor is "digital pedagogical practices," in which teachers understand ICT to be a tool that enables learners' engagement with problem-based activities. These factors illustrating different ICT practices indicate that several approaches can be recognized when defining "digital pedagogy" (Prestridge, 2012, p.453). Milton and Vozzo (2013) agreed with Prestridge (2012) that the definition of "digital pedagogy" contains many variations and subtleties—it is not merely the use of technologies in teaching.

Digital pedagogical competencies are referred to here as the skills teachers need to integrate digital technologies successfully into teaching. Apelgren and Giertz (2010, p.30–31) argued that pedagogical competence comprises six aspects: *attitude*, *knowledge*, *ability*,

adapting to the situation, *perseverance*, and *continuous development*. "Attitude" refers to the fundamental pedagogical outlook that facilitates the creation of practices to promote students' learning. "Knowledge" comprises teachers' subject knowledge and understanding of the teaching process and methods. "Ability" refers to the skills needed to plan and organize activities and to present information to students in an appropriate way. "Adapting to the situation" means that teachers can handle a diversity of factors to optimize students' learning. "Perseverance," in this context, refers to teachers' commitment to maintaining high quality in their teaching. Finally, "continuous development" refers to teachers' understanding that pedagogical competence is not a static skill but is rather something that always needs to be evaluated and developed (Apelgren & Giertz, 2010, p.30–32).

From (2017) took a similar approach in defining "pedagogical digital competence" (PDC), seeing it as a new dimension of contemporary teachers' pedagogical skills and competencies (p.43). PDC has three levels: the interaction level, the course level, and the organizational level. The interaction level involves pedagogical interaction with students, the course level includes the design process and implementation of digital technologies in courses, and the organizational level comprises the educational goals and strategies being developed throughout the organization. Therefore, PDC is connected to teachers' knowledge, skills, and attitudes in relation to digital technology, learning theory, and context (From, 2017, pp.47–48).

Mishra and Koehler (2006) developed a teacher knowledge framework for technology integration. The technological pedagogical content knowledge (TPACK) framework attempts to describe how the three main components of teachers' knowledge relate to each other. The first component, *content knowledge*, describes teachers' knowledge about the subject being taught. The second component, *pedagogical knowledge*, refers to teachers' understanding of the processes and methods of teaching and learning. The third component, *technological knowledge*, refers to teachers' ability to apply technology productively at work and in their everyday lives (Mishra & Koehler, 2006).

While the TPACK framework is a teacher-centered approach to technology integration, Redecker (2017, p.8) sought a more student-centered approach. He created a framework for the digital competence of educators (DigCompEdu) that attempts to define the specific digital competencies that educators need to tap the potential of digital technologies in education. Specifically, the DigCompEdu framework takes the learner's role into consideration as well, which is not emphasized in the TPACK framework devised by Mishra and Koehler (2006). In Redecker's (2017)

DigCompEdu, educators' pedagogical competencies are divided into four segments: digital resources, teaching and learning, assessment, and empowering learners. "Digital resources" refers to educators' ability to choose and apply digital resources effectively to support their teaching. "Teaching and learning" refers to designing, planning, and implementing various methods of digital technology used in different phases of the teaching and learning process. "Assessment" is the use of digital technologies for formative and summative assessment of learners' performance and behavior. Finally, "empowering learners" refers to the use of digital technologies to facilitate learners' active engagement. Digital technologies can support learning by making it possible to personalize education depending on learners' needs (Redecker, 2017, pp.19–22).

Research questions

The first aim of the study was to find out how the dimensions of digital pedagogy are conceptualized in the current literature. This was done by examining its pedagogical orientation, pedagogical practices, and digital pedagogical competencies. The second aim of the study was to define a model based on the dimensions of digital pedagogy. As such, the following research questions were identified:

1. How are the dimensions of digital pedagogy conceptualized in the current research literature?
2. What kind of model can be defined based on the dimensions of digital pedagogy?

Methodology

The literature review is a significant part of any research or development work. A basic goal in conducting a literature review is to help the researcher become familiar with the current research topic and recognize areas of concern that might point to specific matters worth studying in the future. Through a literature review, researchers can gain an understanding of the context in which the research topic exists and develop their knowledge on the topic (Hart, 1998, pp.13, 26–27; Gray, 2004, p.52). Creswell (2018, p.29) stated that there is no single way to conduct a literature review, but many researchers agree that it is about capturing, evaluating, and summarizing the literature.

In the current review, studies related to the topic were located and summarized following Creswell's (2018, pp.29–30) steps in conducting a literature review, as follows:

1. Identify keywords
2. Choose databases

3. Begin searching
4. Locate related articles and books
5. Identify useful literature
6. Design a literature map
7. Assemble the literature review

Literature search

The keywords were identified from preliminary readings and were used as search terms in each of the chosen databases. The search terms used were as follows: digital pedagogy, competence, skill, knowledge, pedagogy, teaching, digital, technology, and pedagogical orientation, including various combinations of these terms. The information specialist at the author's university library was consulted to ensure the search terms' suitability for each of the chosen databases. The searches were conducted in May 2020 using various online retrieval systems of scientific articles and databases, which are listed in Table 1.

The searches were conducted using EBSCOhost, ProQuest, and the Association for Computing Machinery (ACM) Digital Library, which are online retrieval systems for scientific articles related to the educational, psychological, and behavioral sciences. The search terms were adjusted as needed for the retrieval system. The searches were targeted to three databases: Academic Search Elite, the Education Resources Information Center (ERIC), and the ACM. Table 2 presents the databases used and the search terms used in each of them.

"Digital pedagogy" as a search term provided a total of 99 results among all the databases. While the term was mentioned in each of the articles, it was not defined in most cases. The articles did not provide sufficient information about digital pedagogical orientation, practices, or competencies; this meant that the literature search had to be widened by employing more versatile search terms. Digital pedagogy is often linked to the pedagogical use of technology or successful technology integration in teaching, which led to the idea of looking for information about the use of technologies in teaching.

Generally, the literature searches in the ERIC database provided the largest number of articles, while the searches in the ACM database provided the smallest number of articles. The articles found in the ERIC database focused mostly on the pedagogical use of certain digital technologies or were associated with teachers' professional development through organizational measures. The articles in the ACM database were mostly focused on research related to technology but were not related to the pedagogical use of technology. The searches in the Academic Search Elite database provided most of the related articles about the topic of this review. Altogether, these searches provided all the articles included in this literature review.

Inclusion and exclusion criteria

The inclusion and exclusion criteria were defined based on the research aims and questions: to find information relating to the concept of digital pedagogy and to teachers' digital pedagogical competencies. Table 3 presents the inclusion and exclusion criteria used in this research. The articles included in the literature review had to be peer-reviewed, written in English, and published between the years 2014 and 2019. Articles published in 2020 were not included in the literature review because 2020 was ongoing at the time the searches were conducted. Both empirical and theoretical research articles were included because both article types could provide valid information concerning this topic. The study also considered only articles that either defined the concept of digital pedagogy or focused on the pedagogical use of technology. Several articles were either related to the integration of a

Table 1. Online retrieval systems and databases.

Online retrieval systems of scientific articles	Databases
EBSCOhost	Academic Search Elite
ProQuest	Education Resources Information Center (ERIC)
Association for Computing Machinery (ACM) Digital Library	ACM

Table 2. Search terms and results from various databases.

Academic Search Elite

TX("digital pedagogy")
SU(pedagogy OR teaching) AND SU(competence OR skill OR knowledge) AND SU(digital OR technology)
SU(digital OR technology) AND TX(pedagog* orientation)
SU(educational technology) AND SU(teaching or pedagogy) AND SU(school)

ERIC

  NOFT("digital pedagogy")
  SU(digital OR technology) AND SU(teaching OR pedagogy) AND NOFT(pedagogical orientation)
  SU(digital OR technology) AND SU(pedagogy) AND SU(skill OR competen*)
  SU(educational technology) AND SU(teaching) AND SU (pedagogy)

ACM

  ("digital pedagogy")
  (teaching OR pedagogy + teachers + technology + OR +digital)
  (+teachers digital OR technology + pedagogical +competence)

Table 3 Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Peer reviewed	Does not focus on teaching
Written in English	Focuses on the pedagogical use of a specific technology
Published 2014–2019	Focuses on teachers' competencies concerning specific technology
Presents empirical or theoretical research	Focuses on teaching about digital technologies
Includes the concept of digital pedagogy	
Focuses on the pedagogical use of technology	
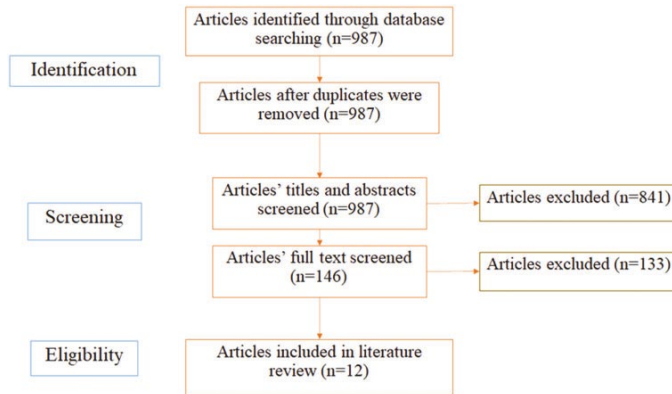
Figure 1. The identification and screening process for the literature used in this study.

certain technology in teaching or focused on a group of people other than those working in a teaching profession; these articles were excluded from the review.

Data extraction

The data extraction process began with the identification of articles from the three chosen databases. This was followed by screening the articles. Figure 1 illustrates the article extraction process.

Literature searches in the three selected databases identified a total of 987 articles. The searches did not provide any duplicates. The 987 articles' titles and abstracts were screened to exclude ineligible articles. The screening of the articles' titles and abstracts focused on finding the keywords and determining whether the context of the study was suitable for the scope of this research. In total, 146 articles were retained, at which point the full text of the articles was screened. At the end of the screening process, 12 articles were included in the literature review and they were published between the years 2014 and 2018. Any of the articles published in the year 2019 did not meet the inclusion criteria. The excluded studies did contain some keywords but did not correspond with

the focus of the research. First, several of the excluded articles included "digital pedagogy" as a keyword but did not define it; defining "digital pedagogy" was one of the inclusion criteria. Second, many of the articles did not focus on the field of teachers' competencies concerning technology integration in teaching. Articles may have discussed teachers' competencies concerning the use of certain digital technology but did not relate to the competencies they needed to integrate digital technologies into their teaching. Last, some excluded articles focused on teaching students about digital technologies rather than the pedagogical use of those technologies.

Chosen articles and their contents

The chosen articles defined "digital pedagogy," discussed pedagogical orientation, pedagogical practices related to digital pedagogy, or conceptualized teachers' digital pedagogical competencies. Table 4 presents the topics discussed in each of the 12 chosen articles.

This study aimed to provide a model for digital pedagogy by outlining its pedagogical orientation and pedagogical practices, and identifying teachers' digital pedagogical competencies. Thematic analysis was used

Table 4. Chosen articles and their contents.

Study	Pedagogical orientation of digital pedagogy	Pedagogical practices	Teachers' digital pedagogical competencies
Adam (2017)	X		
From (2018)			X
Gillett-Swan and Sargeant (2018)	X		
Greenlaw (2015)	X	X	
Looi et al. (2014)	X		
Mannila et al. (2018)			X
McCarthy et al. (2017)			X
Mena et al. (2018)			X
Montebello (2017)	X		
Pittman and Gaines (2015)	X	X	
Sailin and Mahmor (2018)	X	X	
Wadmany and Kliachko (2014)	X	X	

to explore the contents of the chosen literature in order to create a literature map. Thematic analysis can be conducted in many ways, but all approaches share the aim of identifying interesting themes in the data. This study was conducted following Braun and Clarke's (2006) approach to thematic analysis, which comprises generating initial codes, searching, reviewing, and defining themes. The analysis was conducted using the qualitative data analysis computer software NVivo 12.

Pedagogical orientation was discussed in eight of the chosen articles. While pedagogical orientation was mentioned in more than eight of the articles, it was not related to technology use in teaching; this meant they were excluded from the literature review. Pedagogical practices were discussed in four of the chosen articles. These articles discussed pedagogical practices in relation to the use of digital technologies in teaching. Teachers' digital pedagogical competencies were discussed in four of the chosen articles, which examined the competencies teachers need to integrate technology successfully in teaching.

Results

Dimensions of digital pedagogy

The first aim of this study was to conceptualize the dimensions of digital pedagogy based on the current literature. This section reports the findings gathered for the dimensions of digital pedagogy from the chosen articles. Table 5 presents and summarizes the dimensions of digital pedagogy and their contents according to authors of the 12 chosen articles. One author may present ideas relating to one or more dimensions of digital pedagogy.

The chosen literature was divided into three different dimensions for digital pedagogy. The first dimension included the articles discussing *pedagogical orientation* as related to technology use in teaching. The second dimension concerned discussion of digital *pedagogical practices*. The third dimension comprised articles about teachers' *digital pedagogical competencies*. The following section presents a more detailed introduction to each of the dimensions.

A model for digital pedagogy

The second aim of the study was to define a model based on the dimensions of digital pedagogy. The integration of technology into teaching was mentioned in all the chosen articles as a key part of digital pedagogy. Sailin and Mahmor (2018, p.146) argued that digital pedagogy is the meaningful integration of digital technologies into teaching practices. Montebello (2017, p.165) stated that digital pedagogies are ways in which to embed digital tools or aids into teaching to facilitate the learning process. Both Sailin and Mahmor (2018) and Montebello (2017) agreed that digital pedagogy is the integration of technologies into teaching to enhance students' learning. While these perspectives emphasize the meaningful integration of technologies into teaching, the studies did not comment on any specific pedagogical orientations or practices associated with the pedagogical use of technologies. Figure 2 presents a model for digital pedagogy in which the ideas from the theoretical framework and the selected articles are fused together.

Considering all the definitions above, *digital pedagogy* can be fundamentally defined as the pedagogical use of digital technologies. The main differences among the scholars mentioned above were the ways in which they discussed pedagogical orientation in relation to the use

Table 5. Dimensions of digital pedagogy and their contents by the selected authors.

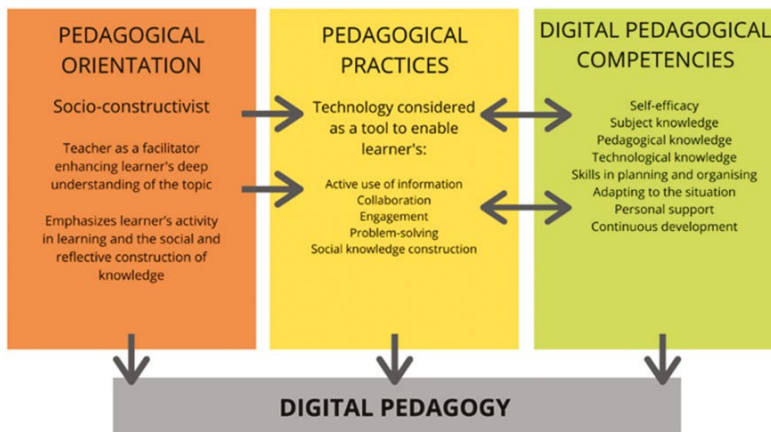| Dimensions of digital pedagogy	Studies	Items from the selected literature
PEDAGOGICAL ORIENTATION	Greenlaw (2015)	Constructivist and learner-centered
	Wadmany and Kliachko (2014)	Teacher as a facilitator
	Montebello (2017)	
	Adam (2017)	Traditional, teacher-centered
	Looi et al. (2014)	Constructivist, student-centered
	Pittman and Gaines (2015)	Sociocultural approach
	Gillett-Swan and Sargeant (2017)	Constructivist approach helps to
	Pittman and Gaines (2015)	integrate digital technologies into teaching
	Sailin and Mahmor (2018)	
	Wadmany and Kliachko (2014)	
PEDAGOGICAL PRACTICES	Wadmany and Kliachko (2014)	Student engagement
	Sailin and Mahmor (2018)	Problem-based
	Pittman and Gaines (2015)	Students as creators of knowledge
	Greenlaw (2015)	Collaboration
DIGITAL PEDAGOGICAL COMPETENCIES	Mannila et al. (2018)	Self-efficacy
	From (2017)	Knowledge, skills, attitudes, and approaches in relation to digital technology
	Mena et al. (2018)	Technological knowledge
	McCarthy et al. (2017)	Pedagogical knowledge
		Personal support

Figure 2. Conceptualization of dimensions and a model for digital pedagogy.

of technology in teaching. The next section, therefore, provides a more detailed discussion of the dimensions of digital pedagogy: 1) pedagogical orientation; 2) pedagogical practices; and 3) digital pedagogical competencies.

Pedagogical orientation. Pedagogical orientation may change when digital technologies are implemented in teaching. In this research, pedagogical orientation refers to teachers' perceptions about effective teaching and learning methods and strategies. Pedagogical orientation is generally divided into two types: constructivist pedagogical orientation and traditional pedagogical orientation. The constructivist pedagogical orientation is based on collaboration, student-centered activities, and students' active participation in discourse rather than on the teacher-led transfer of information. Therefore, technology is considered a cognitive tool that supports students' learning. Traditional pedagogical orientation involves teacher-centered activities in which communication flow is mostly from teachers to students. In traditional pedagogical orientation, technology is used to support teacher-centered activities (Looi et al., 2014, p.224).

According to Pittman and Gaines (2015, p.550), both the constructivist and the sociocultural learning theories facilitate the integration of technologies in the classroom.

Sailin and Mahmor (2018, p.144) argued that the teaching and learning processes should become more constructivist and learner-centered when digital technologies are integrated into teaching. The constructivist and learner-centered approaches are expected to enhance the skills students need in the 21st century (Sailin & Mahmor, 2018, p.146–147). The constructivist and student-centered approaches can be considered even during the planning and implementation phases of digital pedagogy. Gillett-Swan and Sargeant (2017, p.41–42) argued that having a student-centered perspective is essential for planning and implementing digital pedagogy to fully realize the potential of such digital applications. Therefore, digital pedagogy includes more than just the teacher's perspective of teaching and learning; it must also include the students' perspective. According to Wadmany and Kliachko (2014, p.24), the use of technology in teaching is the key element of digital pedagogy; however, its advantages cannot be achieved without appropriate pedagogy. To apply digital pedagogy, the teacher's and students' roles must change. The teacher's role is to work as a facilitator who uses student-centered teaching approaches, makes it possible for students to control their own learning processes, and encourages students in collaborative learning (Wadmany & Kliachko, 2014, pp.23, 26–27). Tondeur et al. (2017, p.561) also noted that the use of technologies in teaching may help teachers to practice becoming more constructivist and student-centered.

Greenlaw (2015, p.896) took a different approach, identifying contrasts between teacher-centered pedagogies and learner-centered pedagogies. Teacher-centered pedagogies are based on content knowledge, theory, and direct instruction, while learner-centered pedagogies are presumed to be more practice-based, wherein skills are learned through collaboration. Teacher-centered pedagogies are not necessarily less effective than learner-centered pedagogies; both have useful features, and teachers should try to find a balance between them when using digital technologies in teaching (Greenlaw, 2015, p.896, 902). Adam (2017, p.36), however, stated that technology-integrated pedagogical practices should not be automatically labeled as constructivist. Montebello (2017, p.165) also argued that digital pedagogies do not guarantee enhanced learning outcomes and that their use still requires teachers to fulfill the classical role as the guide, facilitator, and leader of the learning process.

The scholars mentioned above do not necessarily share the same ideas about the pedagogical orientation of digital pedagogy. Still, constructivist and student-centered approaches seem to be largely associated with digital pedagogy. This might be because many scholars believe that teachers who use constructivist/sociocultural, student-centered pedagogical approaches tend to adopt new technologies in their teaching more easily than teachers who use teacher-centered pedagogical approaches (cf. Montebello, 2017). Therefore, scholars tend to agree that a constructivist/sociocultural, student-centered pedagogical orientation is beneficial for integrating technologies meaningfully into teaching, but they do not necessarily label digital pedagogy as such because it can also be teacher-centered (cf. Greenlaw, 2015). The model for digital pedagogy created in this study, however, presented a socio-constructivist approach to teaching by bringing together constructivist and sociocultural perspectives (cf. Vygotsky, 1978). Traditional and teacher-centered approaches were not presented in the model because the selected literature did not provide enough evidence that they would be beneficial when integrating technologies in teaching.

Pedagogical practices. Pedagogical orientation is clearly reflected in digital pedagogical practices. According to Wadmany and Kliachko (2014), digital pedagogy is pedagogy in an information- and technology-rich learning environment; it is about creating a learning environment in which students can engage in problem-based exercises, with technology integrated into the teaching, learning, and assessment processes. This perspective emphasizes the pedagogical use of technologies but also considers some pedagogical activities and the teacher's and students' roles when technologies are integrated. Learners should take the initiative to learn independently and through collaboration with peers. In many cases, while the use of ICT does not lead teachers to reexamine or change their current practices concerning teaching and learning, constructivist pedagogical beliefs tend to help teachers adopt technology and use it effectively in teaching (Wadmany & Kliachko, 2014, pp.23, 26–27).

Digital pedagogy should involve more than the simple use of technology in the classroom; the use of technology should be based on problem solving and developing higher-order thinking skills (Sailin & Mahmor, 2018, pp.146–147). Pittman and Gaines (2015) stated that the sociocultural approach emphasizes giving learners the opportunity to contact other individuals and parties who are not in their immediate vicinity with the help of various media or technologies. Therefore, learners should become the creators of knowledge themselves by interacting with the environment (Pittman & Gaines, 2015, pp.540, 550).

Prestridge (2012) categorized teachers' ICT practices into four factors (see p. 2). The ideas presented by the authors above are similar to the fourth and last factor, whereby teachers understand ICT to be a tool that enables learners' engagement with problem-based activities. Student engagement, problem-based exercises, collaboration, and social knowledge construction are emphasized among scholars with regard to digital pedagogical practices. Therefore, they were considered in the model for digital pedagogy.

Digital pedagogical competencies. Integrating digital technologies into teaching requires the teacher to possess several skills or competencies. This section describes how such digital pedagogical competencies are seen in the reviewed articles. Mena et al. (2018, p.588) stated that digital competencies include the contents, skills, knowledge, and attitudes that connect technical expertise with pedagogical purposes to enhance students' learning. Such competencies are needed to integrate technology into regular teaching practices. Even though Mena et al. (2018) referred to "digital competencies" instead of "digital pedagogical competencies," the authors seem to mean the same thing. Mishra and Koehler's (2006) TPACK framework resembled Mena et al.'s (2018) definition of "digital competencies," although Mena et al. included *attitude* as one of the four main competencies.

Mannila et al. (2018) noted that teachers' self-efficacy is a key factor in the implementation of technologies in teaching because it comprises individuals' resilience and perseverance in facing challenging situations and problems. Low self-efficacy suggests a higher chance of failure in completing the tasks at hand. High self-efficacy, however, suggests the will and ability to put more effort into the tasks at hand, decreasing the chance of failure. Therefore, self-efficacy should also be considered in the development of teachers' technological skills and knowledge (Mannila et al., 2018). The concept of self-efficacy is absent from both Redecker's (2017) DigCompEdu framework and Mishra and Koehler's (2006) TPACK framework.

From (2017) defined *PDC* as the knowledge, skills, attitudes, and approaches related to digital technology, learning theory, subject, context, and the relationships among these concepts. From's (2017) ideas closely align with Mannila et al.'s (2018) and Mena et al.'s (2018) discussions about competencies in digital pedagogy because, in all cases, successful technology integration in teaching requires more than plain technological, pedagogical, and content knowledge. McCarthy et al. (2017, p.73) noted that, in addition to technological and pedagogical support, personal support—such as peer collaboration and coaching—is needed when digital technologies are integrated into teaching.

Therefore, the integration of digital technologies into teaching also requires different types of support from the working environment.

The digital pedagogical competencies presented in the model are one way of comprehending the skills teachers need to integrate digital technologies into teaching. The competencies included in the model are related to teachers' self-efficacy and personal knowledge areas in relation to the integration of digital technologies; they also consider some aspects of the working environment, such as personal support and continuous development.

Limitations

The literature search conducted in this review returned hundreds of articles, but only a few of them related appropriately to the topic of this research. In many cases, the articles lacked conceptual clarity concerning digital pedagogy, which limited the number of articles that could be included in this literature review. Most of the excluded articles were dismissed during the screening phase; therefore, there is a chance that some excluded articles might have been included if the full text were screened. The screening of the articles' titles, abstracts, and full texts was, however, conducted carefully, and articles were only excluded from the literature review if they lacked the required level of detail or precision.

The present study was limited to articles that clarified the concept of digital pedagogy with a sufficient level of detail and precision. However, the review could also have been conducted by including articles in which the concept of digital pedagogy was mentioned but not defined. This would have provided interesting information about the use of digital pedagogy but would have required the use of a different type of analysis; limited time and resources created boundaries that required the researcher to make certain choices, one of which was limiting of the scope of the review to articles that defined "digital pedagogy." The model for digital pedagogy requires further evaluation and development to support educators' use of digital technologies in teaching. The model provided by this review, however, provides a good starting point for familiarizing oneself with the topic.

Discussion

Defining the concept of digital pedagogy was the most difficult part of this study. The searches provided hundreds of articles that included the concept of digital pedagogy, but the term itself was not defined at all in most cases. Many scholars seem to expect the reader to be familiar with the concept. Still, "digital pedagogy" was understood differently in many articles.

This review gathered together various dimensions of digital pedagogy and can help in becoming familiar with it. As a result of this review, it is evident that there is a need to better understand why teachers are not integrating digital technologies into teaching and what kinds of skills they need to do so. It is not sufficient to have technological skills, subject content knowledge, and pedagogical knowledge, as even the teachers who possess all these skills do not necessarily integrate technology into their teaching. The reason for this may be teachers' attitudes or lack of resources or support; however, pedagogical orientation may also factor into this phenomenon. Teachers' attitudes toward technology use in teaching may have been affected by good or bad experiences with digital technologies. Bad experiences may be the result of low self-efficacy, lack of knowledge, or lack of peer collaboration. The possibilities raised by these scenarios seem to be endless, as there are different individuals and contexts, so greater insight is required to determine the main causes.

There also remains a need for discussion about what is meant when discussing digital pedagogy and what competencies are needed to integrate digital technologies meaningfully into teaching. With regard to Mishra and Koehler's (2006) TPACK framework, this involves the question of what may be missing rather than whether the wrong factors have been included. Rust (2019, p.126) argued that knowledge about pedagogy and technology also requires positive beliefs about the potential of new technological devices and tools to integrate them successfully in teaching. Teachers must reflect on their own beliefs about teaching and learning and decide whether they are willing to change them and integrate new technological tools into teaching. This kind of critical digital pedagogy does not, however, necessitate the constant integration of every new and upcoming digital tool; instead, it emphasizes only what is necessary for efficient learning (Rust, 2019, pp.126–127). Teachers must believe in their own pedagogical choices and should not increase their workload unnecessarily by integrating technologies that do not serve the right purposes.

The model for digital pedagogy provided by this study can help educators utilize digital technologies in their work. Testing the model could provide valuable information and help in evaluating and developing it further. Subsequent research could involve educators using the model in planning their teaching. This could reveal more information about pedagogical orientation, pedagogical practices, and digital pedagogical competencies related to the use of digital technologies in teaching. For further studies, it would be beneficial to include the learners' perspective in order to gain more information about the changes digital pedagogical solutions may cause on the whole learning process. Examining the learners' perspective in future studies could broaden our understanding of digital pedagogy and at the same time provide means to evaluate the effectiveness of the learning process involving digital pedagogical solutions.

Conclusion

This article introduces a conceptual model for digital pedagogy to provide tools for teachers to rethink their pedagogical orientation, pedagogical practices, and competencies when integrating digital technologies into their teaching. The literature search yielded hundreds of articles about the integration of technology into teaching. These articles often related to enhancing teachers', teacher students', or teacher educators' competencies or skills in digital pedagogy. Mishra and Koehler's (2006) TPACK framework was the most common framework discussed in the articles. One interesting result of the literature search was that even though the concept of digital pedagogy was mentioned in many articles, it was often not defined at all. However, in such cases, "digital pedagogy" seemed most often to refer to the use of technologies in teaching.

The systematic literature review and article analysis demonstrated that the concept of digital pedagogy is used in many contexts, and scholars have various definitions of it (cf. Adam, 2017; Greenlaw, 2015; Wadmany & Kliachko, 2014). All scholars agreed, however, that it relates to technology use in teaching. Teachers' pedagogical orientation was raised as a key issue in the context of digital pedagogy. In most of the reviewed articles, the scholars agreed that technology integration is more likely to be successful if the teacher possesses a constructivist, student-centered pedagogical orientation (cf. Montebello, 2017; Wadmany & Kliachko, 2014). This might be one reason why digital pedagogy is seen among scholars in the field as a more constructivist and student-centered approach to teaching than is teacher-centered pedagogy. However, not all scholars shared the same view of the pedagogical orientation of digital pedagogy, and many noted that digital pedagogy should not be automatically labeled as constructivist or student-centered because it can also be traditional and teacher-centered (cf. Adam, 2017; Greenlaw, 2015).

This literature review identified the need to determine why some teachers do not integrate technologies into their teaching even though they have all the competencies outlined in previous frameworks, such as Mishra and Koehler's (2006) TPACK and Redecker's (2017) DigCompEdu. Teachers' digital pedagogical competencies were discussed broadly and from

different points of view in the reviewed articles, and all the scholars shared the idea that teachers need more than plain technological, pedagogical, and content knowledge in order to integrate technologies successfully into their teaching (cf. From 2017; Mena et al., 2018). Attitude, self-efficacy, and peer collaboration skills were raised as some competencies that can contribute to the successful integration of technologies in teaching (cf. McCarthy et al., 2017; Mannila et al., 2018).

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Sub-Study II

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A community of practice approach to the co-development of digital pedagogy: a case study of primary school teacher education practicum

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ABSTRACT

This case study aims to identify which characteristics that define the concept of Community of Practice (CoP) can be recognised at the primary school teacher education practicum and how stakeholders perceive digital pedagogy in the context of practices for co-development. The case study took place in a primary school teacher education practicum at the University of Lapland in Finland and involved teacher educators ($n = 2$), student teachers ($n = 5$), and in-service primary school teacher mentors ($n = 6$) who are considered the stakeholders of the case study. The results indicate that the practicum included characteristics that, to some extent, supported the CoP model, including the criteria *negotiated goal*, *addressed challenges*, *co-development of the community*, *leveraged individual's expertise*, and *regular and intentional interaction*. The stakeholders perceived digital pedagogy as an approach that, through employing variety of digital technologies in their teaching practices, can enhance the pupils' learning process.

Introduction

This case study aims to identify which characteristics that define the concept of a Community of Practice (CoP) can be recognised at the primary school teacher education practicum and how stakeholders perceive digital pedagogy in the context of practices for co-development. The stakeholders are teacher educators, student teachers, and in-service primary school teachers acting as mentors within the context of a teacher education practicum – a requirement of the Primary School Teacher Education curriculum at the University of Lapland, Finland. It is a timely investigation, as the COVID-19 pandemic has caused a distinct global rise in the need to teach remotely, and has subsequently contributed to an increased interest in the use of digital pedagogy. The collaboration between the university as a place of research and the school as a place of institutionalised learning has been reported to be beneficial for opening up possibilities for mutual learning (Resch, Schrittesser, and Knapp 2022; Kyllönen 2020). The topical research, however, does not provide practical solutions on how to carry out this partnership between universities and schools in the context of teacher education practicums. This

case study provides an aspect on how university-school collaboration can be arranged through teaching practicums in a way that all the stakeholders involved have the potential to co-develop digital pedagogy and learn from each other.

The investigation was carried out following a deductive approach that used Wenger's (1998) conceptual model of the Community of Practice (CoP) to theorise the co-development of digital pedagogy by the school community during the practicum period.

Simply defined, a CoP is a group of people who pursue shared goals, which results in collective learning (Wenger 1998). While CoPs are formed with the aim of providing tools for the systematic leverage of knowledge inside organisations, they are not necessarily restricted to a single organisation; a CoP may connect people across organisational and geographical boundaries. (Wenger-Trayner and Wenger-Trayner 2015.) In this case study, such organisational boundaries are crossed, as the co-development practice described herein involves a university and several primary schools. Therefore, social theories of learning, which consider learners as social beings who learn via participation (Bandura 1977), have also been considered when discussing the concept of a CoP.

The pedagogical use of digital technologies (referred to throughout this paper as 'digital pedagogy'), and its potential to enhance prevailing school practices during practicum is an idea that is shared by teacher educators, student teachers, and in-service primary school teachers. Kyllönen (2020) argues that digital pedagogy can be understood as an approach to teaching in which the instructor uses digital technologies in the planning, implementation, and evaluation processes to support student learning. According to the new Finnish National Core Curriculum for Basic Education adopted in 2016, digital pedagogy is central to learning; hence digital technology-related skills are now included in the curriculum as part of the transversal competencies (Finnish National Board of Education 2016). The curriculum also states that in-service teachers need the technological and pedagogical knowledge for making use of various technologies based on their own needs and at the same time need to understand the consequences of their choices (Tanhua-Piiroinen et al. 2019; Huhtala and Vesalainen 2017). Hence, while staff development may sometimes focus on the technical use of certain technologies, successful implementation in teaching also requires training on how to use them in a pedagogically meaningful way (van der Rijst, Baggen, and Sjoer 2019).

In the following sections, the context of the case study is described. This is followed by a detailed description of the use of the CoP model as a theoretical framework for the case study, along with the precise research questions this paper seeks to answer. The research methodology employed, including how data collection and analysis were carried out, is then described. Subsequently, an analysis of the data in terms of which practices identified in the CoP model support the co-development of digital pedagogy is presented, followed by a discussion and conclusion.

Research context

The case study presented in this paper focuses on a localised group of what will be referred to as 'stakeholders' (Yin 2014) who belong to the aforementioned Primary School Teacher Education Programme in the Faculty of Education at the University of Lapland. Stakeholders are teacher educators, student teachers, and in-service primary school teacher mentors associated with the fifth and last practicum period that student teachers

complete during the final year of their studies (discussed below). The stakeholders discussed together before the start of the practicum a common goal for co-development which in this case came to be digital pedagogy. The negotiated goal reflected on student teachers' master's thesis topics which they were to work with in seminars. The seminars provided a context for support while conducting research during their practicum periods. The student teachers' research during the practicum periods were meant to prepare them in taking part in a research-based development process and documenting it through their master's theses. The student teachers and in-service teachers were expected to work together in the school to make some practical pedagogical changes in the classroom environments. Teacher educators took part in the co-development according to their expertise and supported student teachers' research process related to the co-development. Elvira et al. (2017) recognised three learning processes that foster the development of university students' professional expertise: 1) transforming theoretical knowledge into practical knowledge, 2) explicating practical knowledge into theoretical knowledge, and 3) reflecting on both theoretical and practical knowledge by using self-regulative skills such as evaluation. As such, linking the theoretical process of developing a thesis with the practice of enhancing prevailing school practices may foster the evolution of students' professional expertise.

The first four practicum periods are completed in the Teacher Training School at the University of Lapland. The Teacher Training Schools are part of the universities and one of their main goals is to provide training ground for student teachers and prepare them for their future profession. In this case study however, the interest lies in the practicum where student teachers are permitted to choose the school in which they wish to complete it. This practicum was chosen as a context of the study because student teachers are placed in ordinary school environments supported by in-service school personnel. It is part of the Primary School Teacher Education Curriculum of the University of Lapland and is worth 5 European Credit Transfer and Accumulation System (ECTS) credits. Student teachers are expected to consider their own interests for their future career when choosing the school in which to complete their practicum period. The duration for the practicum is four weeks, during which time the student teachers must assume an appropriate level of responsibility for the planning, teaching, management, and administration of the class to which he or she has been assigned.

Theoretical framework

A community of practice approach to the teacher education practicum

Teacher education programmes in Finland aim to educate teachers with the skills to solve problems independently and using the latest educational research. Therefore, creating a link between practice and research should be emphasised in teacher education (Toom et al. 2010). For student teachers, teacher education practicum (hereinafter referred to simply as 'practicum') offer a context in which to practice their future profession, but a practicum is also a way to generate partnerships among different stakeholders like teacher educators and in-service teachers, and creates a platform for interaction.

According to Tiainen, Korkeamäki, and Dreher (2018), practicums should be arranged to support learning in teams. Working in teams and helping each other to view classroom

situations from different perspectives (which can lead to co-development) fulfils a prerequisite for knowing how to reflect your own actions. When student teachers are accustomed to reflecting their working principles in teaching practicums during their education, they are more likely to maintain this approach in their future working life (Tiainen, Korkeamäki, and Dreher 2018).

According to the recent conceptualisation of the CoP, as a tool it will be the most effective when it includes the following three elements: 1) the domain, 2) the community, and 3) the practice (Wenger 1998; Wenger, McDermott, and Snyder 2002; Wenger-Trayner and Wenger-Trayner 2015). These three elements are discussed in detail in the following sections.

The domain

The domain refers to the shared domain of interest among a group of people. The shared domain of interest is valued as collective competence which can be enhanced by learning between group members, but is not necessarily recognised as 'expertise' outside of the community. The group members must *negotiate a common goal* and *address challenges* concerning their domain of interest in order to develop their collective practices (Wenger-Trayner and Wenger-Trayner 2015; Wenger 1998). According to Tuhkala (2019), involving in-service teachers in negotiations can prevent unwanted situations where development is in conflict with teachers' everyday needs. Such reciprocal partnerships between teacher educators, student teachers, and in-service primary school teachers create possibilities for all three to overcome challenges and learn from one another. Teacher educators, for example, may gain topical information from the field to develop their curricula, while in-service teachers may develop their practices based on current research (Helin 2014).

In this study, the shared domain of interest for teacher educators, student teachers, and in-service teachers is digital pedagogy, or the pedagogical use of digital technologies. Digital pedagogy became a shared domain of interest through negotiation because the student teachers were specifically interested in experimenting variety of digital technologies in the actual classrooms and in-service teachers wanted to update their pedagogical practices.

It is possible to integrate technologies in teaching in various ways, and it is for this reason that digital pedagogy is the subject of co-development in this case study. For example, Maslin and Smith (2017) argue that a practicum can provide a context for student teachers to practice and support growth in confidence for the use of digital technologies as pedagogical tools. In another example, according to Montebello (2017), digital pedagogy is considered as a way to embed digital tools in order to enhance the learning process, and that the use of technology in teaching may affect the teacher's pedagogical solutions. Hinostroza et al. (2016) noticed in their research that teachers use digital technologies most frequently in combination with traditional teaching practices, in which technology is used to support classroom management, presenting information, and giving instructions. Yet another example is provided by Wadmany and Kliachko (2014), who state that technology is the main essence of digital pedagogy, but that without appropriate pedagogical solutions, its advantages cannot be achieved. When integrating digital pedagogy, the teacher's role is to facilitate students' collaborative learning and to encourage them take more responsibility for their own learning processes. (Wadmany and Kliachko 2014). Similarly, Engeness and Edwards (2016) argue that in

digital pedagogy, the teacher is a guide who supports students' collaboration and helps them reach the learning potential facilitated by digital tools. Each of these accounts illustrates how the development of digital pedagogy and its integration into prevailing educational methodologies would be of benefit to multiple stakeholders.

The community

The community comprises the relationships and activities that allow members to interact and share information with one another. Therefore, a CoP cannot be created simply by virtue of a shared domain of interest. The members need to engage in *regular and intentional interaction* through activities in which they may learn from one another (Wenger-Trayner and Wenger-Trayner 2015; Wenger 1998). However, Tuhkala (2019) argues that participation in development work does not necessarily require physical presence, but that other forms of influencing, such as commenting or proposing changes, may suffice. In this study, the community was created through the practicum. Teacher educators, student teachers, and in-service primary school teachers interacted with one another in the beginning of the practicum in order to discuss the prevailing practices of the school and to decide on goals for co-development. The in-service teacher mentor therefore needed to work not only as a supervisor, but also as a co-developer with the student teacher. According to Jaspers et al. (2014), teachers may confront challenges when simultaneously fulfilling both the role of teacher and mentor. Student teachers and in-service teacher mentors were therefore in constant interaction during the practicum because they were working together in the school context.

The practice

The practice refers to the shared repertoire of resources such as experiences, stories, or tools that is developed into shared practices by members of the community. The shared repertoire works as a resource for *leveraging individuals' expertise* when *co-developing the community* (Wenger-Trayner and Wenger-Trayner 2015; Wenger 1998). Student teachers, in-service teachers, and teacher educators may have different insights about digital pedagogy, and it is these insights that comprise the shared repertoire of resources in this study.

According to Edmondson and Harvey (2018), knowledge diversity possessed by the individual team members alone does not create performance benefits for the team. Knowledge diversity can only be beneficial when team members face a creative task or challenge that arouses interaction (Edmondson and Harvey 2018). Building on this notion, it is important to acknowledge From's (2017) argument that digital technology-related pedagogical skills and competences can take effect on three levels: the interaction level, the course level, and the organisational level. The interaction level refers to the actual pedagogical solutions implemented in the classroom. The course level involves the course design process and plans for implementing digital technologies. The organisational level refers to the strategies and educational objectives shared by the whole school organisation. (From 2017.) The teacher educators, student teachers, and in-service teachers may develop prevailing school practices at all three levels during the practicum.

Mishra and Koehler (2006) introduce the Technological Pedagogical Content Knowledge (TPCK) framework to illustrate three different knowledge areas required for the successful integration of technology in teaching. The first area is content knowledge,

which concerns the information about the subject to be taught. The second area is pedagogical knowledge, which comprises the teacher's overall knowledge on learning processes, teaching methods, and his or her relation to learning objectives. The third area is technology knowledge, which refers to the information needed to operate the technologies to be used (Mishra and Koehler 2006). Therefore, student teachers, teacher educators, and in-service teachers should support one another and discuss their areas of expertise during the practicum.

Research questions

Investigations were carried out for the purposes of answering the following research questions:

(1) Which characteristics of a CoP can be recognised in the Primary School Teacher Education practicum?
(2) How do the stakeholders perceive digital pedagogy in the context of practices for co-development?

The findings for the research questions have the potential to provide tools for evaluating and developing the existing structures and practices of the practicum.

Research methodology

In a case study, interests are placed on a certain localised group of actors (Tierney and Dilley 2001; Yin 2014). In this case, the localised group consists of teacher educators ($n = 2$), student teachers ($n = 5$), and in-service primary school teacher mentors ($n = 6$), who took part in the practicums. In this case, the practicums served as a context for the co-development of digital pedagogy. Therefore, the focus of the case study was to obtain an in-depth understanding of the selected case rather than empirical generalisation. In a case study it is also essential to look for preliminary theoretical concepts in order to define the study's outline (Yin 2014). In the present case, Wenger's (1998) Community of Practice (CoP) and topical research related to digital pedagogy provide a framework for conceptualising the co-development of digital pedagogy.

Data collection

As is typical for case studies (Yin 2012), the body of data gathered for this study consists of several sets. The first set of data consists of the instructional documents for the practicum, selected because they provide information about the planned aims and content of the

Table 1. Types and lengths of the instructional documents.

Instructional document	Length of the material
Teacher education practicum's course description	217 words
Instructions for in-service teacher mentor	162 words
Total	**379 words**

practicum. Table 1 represents the names of the instructional documents analysed as part of this study, along with their lengths.

The instructional documents consist of the practicum's course description and instructions for the in-service teacher who is to mentor the student teacher during the practicum. The former document is part of the University of Lapland Teacher Education curriculum and includes learning objectives, content, and teaching and learning methods, while the latter are meant to work as guidelines for the stakeholders involved. Instructions for the in-service teacher mentor focus primarily on the teacher's responsibilities during the practicum.

The second set of data was collected by means of qualitative interviews with teacher educators, student teachers, and in-service primary school teacher mentors who were involved in the selected case. The interview data provided information about the practical events that took place during the practicum. The practicums were completed in three different primary schools where the interviewed in-service teachers worked. Three of the students completed their practicum in the same school, but at different times. The same teacher educators were involved in all of the practicums. All the stakeholders were asked similar questions considering the collaboration among them (e.g. *What was your role in the co-development?*) and their perceptions about the co-development of digital pedagogy (e.g. *What should be the role of digital technologies in the classroom?*). Each of the interviews lasted 20–35 minutes. Table 2 represents the number of participants and the length of interview transcriptions.

The qualitative process of interviewing is often characterised as a guided conversation (Warren 2001), and the use of a semi-structured interview design (Wilson 2016) fostered this conversational nature of data collection. Semi-structured interview design made it possible to make minor modifications to interview questions during each interview and to ask follow-up questions to lessen the chances of leaving valuable information out of the study (Wilson 2016). The interviews consisted of two parts. The first part included questions about the practices supporting co-development during the practicum. Questions in the second part of the interview were related to the co-development of digital pedagogy.

The interviews were conducted in person, apart from those carried out over the phone with two of the student teachers and one in-service teacher mentor. The advantage of in-person interviews is that it is possible for the interviewer to observe the participant's body language and facial expressions (Wilson 2016). Preparation for the interviews included studying the topics on which the interviews were based and carrying out a practice interview with a colleague to test the questions being asked. According to Dilley (2000), proper preparations help the researcher to focus on the interview and make comparisons between the things that the participant is saying and what the researcher already knows about the topic. The interviews were audio recorded by phone and later transcribed

Table 2. Stakeholders and the length of the interview transcriptions.

Interviews	Number of participants	Length of the material
Teacher educators	2	5470 words
Student teachers	5	7756 words
In-service teacher mentors	6	12098 words
Total	**13**	**25324 words**

verbatim. Recorded audio files were stored on a personal OneDrive for Business folder which is provided by the University of Lapland to its personnel. The stored data was encrypted to guarantee anonymity of the stakeholders.

Data analysis

The collected data were analysed using a qualitative method and a deductive approach. This examination of both theory and collected data fostered the emergence of categories (Drisko and Maschi 2015). A qualitative content analysis consists of three phases: preparation, organisation, and the reporting of results. The preparation phase focuses on collecting and becoming familiar with the data (Elo et al. 2014). In this study, the preparation included uploading the instructional documents and the interview transcripts ($n = 13$) to the NVivo 12 data analysis programme and carefully reviewing them. In a deductive content analysis, the organisation phase consists of a data review for content and coding in correspondence with pre-identified categories (Elo et al. 2014). In this case study, the categories for characterising co-development were based on the three elements of Wenger's CoP model presented in the section on theoretical framework: domain, community, and practice. In addition, five criteria—*negotiated goal*, *addressed challenges*, *regular and intentional interaction*, *co-development of the community*, and *leveraged individual's expertise*—were identified from Wenger's CoP model (cf. Wenger-Trayner and Wenger-Trayner 2015). The data analysis process was continued by coding the five identified criteria in NVivo 12 and looking for examples of each in the collected data. This process of analysis also aimed to reveal which criteria were not fulfilled.

Two criteria for determining whether the element of the domain was present in the co-development practice were identified. The first criterion was the presence of a *negotiated goal*. Its identification required examples related to the area of goal development; the community members must have negotiated a common goal that they are seeking to achieve during the practicum. One negotiated goal was the use of digital technologies in a manner enabling pupils to search and produce information together. The second criterion was whether or not the members had *addressed challenges*, i.e. whether or not the members of the community had negotiated issues together such as the number of usable technologies. A third criterion, *regular and intentional interaction*, which can be measured by how regularly and intentionally the members of the community interacted, must be identified to determine whether the element of the community was present. The last two criteria are used to identify whether the element of practice is present: *co-development of the community* comprises the practices for collaboration and actual outcomes of developing the community such as learning to use digital technologies in pedagogically meaningful way, while *leveraged individual's expertise* concerns how well community members have considered each other's skills and knowledge when developing the community. Examples of such expertise are student teachers' technological skills, in-service teachers' familiarity with school practices and teacher educators' understanding of research design process. For the elements of domain, community, and practice to be considered present, all community members should be somehow involved in fulfilling each of the criteria described above.

Table 3. Identified criteria for characterizing the co-development of digital pedagogy.

Element of CoP	Criteria for characteristics	Items from the instructional documents and interviews
DOMAIN	Negotiated goal(s)	• Discussed in a meeting among the stakeholders • Based on the student teachers' interests and the schools' needs • Activation and collaboration through digital pedagogy
	Addressed challenges	• From the school context • Lack of induction • Amount of usable technologies • Lack of time
COMMUNITY	Regular and intentional interaction	• Student teacher/in-service teacher interaction in the school environment • Teacher educator/student teacher interaction in master's thesis seminars
PRACTICE	Co-development of the community	• Meaningful digital pedagogy • Student teacher's role emphasised in co-development • In-service teacher as a supervisor • Teacher educator as a prospector
	Leveraged individual's expertise	• Student teachers' technological pedagogical knowledge • In-service teachers' subject knowledge and familiarity with the school and classroom practices

Characteristics supporting the idea of a CoP and the co-development of digital pedagogy

The stakeholders had mostly concurring views about the practices of the practicum. Table 3 represents the identified criteria for characterising co-development of digital pedagogy.

Each of the identified criteria for characterising co-development was recognised in the interviews, but not necessarily in the instructional documents. The identified five criteria (see Table 3) will be presented individually in correspondence to the collected and reviewed data in the following sections.

Negotiated goals

The practicum course description or the instructions for in-service teacher mentors did not include any guidelines for the stakeholders to negotiate a common goal for the practicum. All of the interviewees, however, mentioned that they had negotiated a common goal for the practicum. *Negotiated goals* were defined in all cases in the beginning of the practicum in a meeting that included the teacher educator, student teacher, and in-service teacher mentor, described by one interviewee as follows:

> It was interactive; the trainee first presented his own ideas and then I presented mine, and the principal was present and the university was involved the second time, what was to come and what to do and the goals were specified for the trainee during this discussion (In-service teacher mentor 6).

The goals were negotiated together among the stakeholders. According to Wenger's (1998), the result of the collective negotiation process needs to support all participants' mutual engagement. According to the interviewees, common goals were negotiated because they had to be linked with the topics of the student teachers' master's theses:

> Multidisciplinary module from the master's thesis provided the theme and they (in-service teacher mentors) wished for that digital technology and media content (Student teacher 4).

The outcomes of the negotiations were different in each of the practicums because they were based on the school's needs and the interests of the student teacher. The student teachers also needed to consider the content of the practicum from the perspective of a researcher, because the practicum was meant to provide a context in which they were able to collect research data. Therefore, the negotiated goals were not defined by any of the participants alone, but rather together in the beginning of each of the practicums:

> The project is research-based by design, so we need to have some suggestion, some more theoretical, conceptual framework, what we think about multiliteracy and digital pedagogy, what they are and how they could be promoted in primary education (Teacher educator 2).

Wenger's (1998) argues that the result of the collective negotiation should not be only a stated goal, but it should also create mutual accountability among the participants. In most cases, the student teacher determined what content was to be taught based on his or her master's thesis, while the need for new pedagogical solutions was expressed by the in-service teacher mentor. Teacher educators also stated that the student teachers' own design-based research projects concerning their master's theses created some framework for the contents of the practicum. One teacher educator declared that the University's role was to provide a conceptual framework for multiliteracy and digital pedagogy and then discuss how these could be promoted in primary education. The mentioned examples are closely related to transforming theoretical knowledge into practical knowledge, which, as it may be recalled, can foster the development of students' professional expertise (cf. Elvira et al. 2017).

The negotiated goals were generally linked to digital pedagogy which is often characterised to require a learner-centred approach to teaching and may this way cause some changes to teachers' pedagogical practices (Wadmany and Kliachko 2014). The interviewees, however, did not report any pedagogical changes while employing new technologies. The reason for this may be that these stakeholders already followed a learner-centred approach to teaching, and therefore did not necessitate any pedagogical changes (cf. Hinostroza et al. 2016).

Addressed challenges

The practicum course description or the instructions for in-service teacher mentors did not include any information about *Addressed challenges*, and this was also the least mentioned characteristic of co-development by the interviewees. Only the in-service teacher mentors mentioned some examples that could be identified as addressed challenges, and they were mostly concerning the school context:

> Use of digital tools is becoming more popular and you are learning and developing it, of course, but then it seems that the pace is so slow and all the time something new appears. (In-service teacher mentor 4)

The interviewed in-service teachers also mentioned having addressed challenges in the stakeholder meeting. Such challenges were related to the lack of induction and time allotted to the use of digital technologies in a pedagogically meaningful way:

> We are not getting sufficient induction of how to use digital technologies (In-service teacher mentor 1).

McCarthy, Maor, and McConney (2017) divided teachers' needs associated with integrating digital technologies in teaching into three different categories: technology needs, pedagogical needs, and personal support needs. The examples about addressed challenges in this study are comparable to technology needs and pedagogical support needs. One in-service teacher mentor also expressed anxiety towards digital pedagogy by mentioning that sometimes teaching the pupils to use a certain technology might take too much time away from actual studying:

> Technologies were not always used in a meaningful way because teaching the kids to use the technology took too much time from the lesson (In-service teacher mentor 6).

To use digital technologies in a pedagogically meaningful way would require a change in classroom practices to support collaboration and allow for pupils to take more responsibility for their own learning (Wadmany and Kliachko 2014). Therefore, in-service teachers should be provided with an induction that is focused on the use of technologies in a pedagogically meaningful way in order to enhance the learning process (cf. Montebello 2017).

Student teachers or teacher educators did not mention having addressed challenges for the co-development project, but they all came from the in-service teacher mentors and were related to school context. However, Midtsundstad and Langfeldt (2020) argue that school development is a constant process between school and place. Teachers' perceptions about what is important for the school shape their roles as members of the community and thus the school culture. Therefore, school development should be interpreted as contextual (cf. Midtsundstad and Langfeldt 2020).

Regular and intentional interaction

The practicum course description did not include any guidelines for the *regular and intentional interaction* among the stakeholders. The instructions for in-service teacher mentors, however, provided them with topics to discuss with the student teacher, such as course planning, and thus furnishing some insight for intentional interactions between the teachers and the student teachers. None of the instructional documents indicated the teacher educator as part of these interactions.

According to the interviewees, *regular and intentional interaction* occurred between the student teachers and in-service teacher mentors throughout the practicum. The student teachers and in-service teacher mentors usually met at least once a week to discuss how the co-development was evolving:

> As the time for lessons began to approach, we discussed about the lesson contents and how it was going, and then there were feedback discussions about how they went (In-service teacher mentor 1).

The meetings between the student teachers and in-service teacher mentors were, in most cases, informal and unplanned, and the student teachers' performance during lessons was

discussed. One teacher educator was only involved in the seminars, and therefore did not meet the in-service teacher mentors at all:

> Yeah, well I haven't met people at school. It was the responsibility of another teacher educator and these students. Then again, I met the students and the other teacher educator when their research was covered in these seminars (Teacher educator 2).

Teacher educators met the students in master's thesis seminars in which they were concentrating more on how to build connections between their research and school co-development projects. While these stakeholders did meet with each other, it was on different occasions. Furthermore, the in-service teachers from different schools did not meet each other at all:

> If you think about co-development, then there should be even more time for joint meetings between their school staff and university researchers and other staff. After all, we haven't really had any meetings where the whole network would have been (Teacher educator 2).

One teacher educator raised the point that there should have been a meeting involving the entire network that included all stakeholders. Wenger's (1998) argues that a key prerequisite for mutual engagement is the ability for members to interact while working. This prerequisite is fulfilled by means of a physical presence between the student teacher and in-service teacher mentor. Teacher educators took part in interaction mostly from a distance by commenting or proposing actions (cf. Tuhkala 2019). Therefore, *regular and intentional interaction* was realised in different ways and on different occasions among the stakeholders.

Co-development of the community

The practicum course description and the instructions for in-service teacher mentors only vaguely emphasised *Co-development of the community*, while the same theme was clearly recognised in the interviews. A certain degree of development was achieved, but it was not always a result of planning, executing, and evaluating the project together. The practicum course description emphasises student's responsibility for taking part in school development:

> Student gets to know how to plan his/her own work based on school curriculum and taking into account the focal points of the school development activities (Practicum course description, p. 1).

The course description, however, does not reference the characteristic of working in collaboration with other stakeholders involved in the practicum. In the instructions for in-service teacher mentors, the teacher's role was emphasised as that of a supervisor and enabler of student development:

> The objective is to provide student with a comprehensive perspective about teacher's work and school development by taking part in the process or planning and executing an own school/class experiment (Instructions for in-service teacher mentor p. 1).

Similarly, the instructions include content for the student involved in the practicum, but this content does not involve the in-service teacher or teacher educator in planning and executing the experiment. Each of the stakeholders, however, mentioned examples of co-

development of the community. According to student teachers, they had the freedom to plan their own lessons and experiment:

> I was given free hands and they (in-service teacher mentors) encouraged me to try new things in there and I got to think about that stuff (planning of pedagogical activities) by myself (Student teacher 5).

According to the interviewees, the student was in charge of planning and making the changes to classroom practices. The in-service teacher mentors stated that they wanted to learn about the use of technologies in teaching in particular from the student teachers:

> We had the expectation that we too would learn it, the classroom teachers would learn it from those students, and then some of this technology would be used that is not normally used here (In-service teacher mentor 5).

The in-service teacher mentors' roles seemed to be to remain less active in the actual planning and development processes when compared to the student teachers' roles. Subsequently, the in-service teacher mentors could reflect on how to incorporate the new methods into their own work. McCarthy, Maor, and McConney (2017) also noticed in their study that several teachers sought simple advice and tips on how to use certain technologies as part of their work. Thus, in some cases the in-service teacher mentors' role in co-development seemed to be closer to that of a supervisor than a co-developer (cf. Jaspers et al. 2014). One teacher educator emphasised the student teachers' possibilities in practicing their skills in practicums, and how as a result the schools could benefit and learn something from the students:

> Great thing is that these students can already design something in advance that will benefit them as well as their practice, but it will also benefit the school where they go to practice (Teacher educator 1).

Teacher educators were not closely involved in the actual co-development process. Wenger's (1998) argues that the development process should include renegotiation of the common goal and a discussion on how the stakeholders may engage more efficiently. According to teacher educators, they remained prospectors of the co-development process, which involved mainly student teachers and in-service teacher mentors. Actual co-development lacked in some cases the shared tasks and challenges necessary to the generation of interaction and collaboration among all stakeholders (cf. Edmondson and Harvey 2018). Co-development was also limited to individual lessons, and therefore did not effect any comprehensive changes in the school as an organisation. Among From's (2017) three levels of pedagogical skill and competence occurrence (interaction, course, and organisational) presented previously, co-development incorporates the interaction level in particular, because the pedagogical changes were made in individual lessons. The course level and organisational level were therefore not affected by co-development in this case (cf. From 2017).

Leveraged individuals' expertise

The practicum course description and the instructions for in-service teacher mentors did not contain any reference to *leveraging individual's expertise*, but it was mentioned by the

interviewees. Student teachers mentioned most often the pedagogical use of technologies as one area of expertise they possessed, while in-service teachers were more familiar with the practicalities concerning the teaching profession:

> I was there all the time helping everyone especially with ICT devices and all digital platforms. And at the end of the practicum, I held a training for them about the basic stuff like what you could do with a computer or a phone with the pupils (Student teacher 5).

Student teachers mentioned the use of ICT devices and different technologies in teaching as one topic they were paying particular attention to during their practicums. They also noted that the in-service teacher mentor wished to learn more about the use of different technologies in teaching. Therefore, the student teachers' areas of expertise is closely related to technological pedagogical knowledge which comprises the understanding of how to utilise various technologies in different teaching and learning settings (cf. Maslin and Smith 2017).

The in-service teacher mentors mentioned subject knowledge and familiarity with school practices and pupils as their areas of expertise (cf. Mishra and Koehler 2006):

> Well maybe all those school practices, what they are, and knowing how to work at this school, and what kinds of practices there are with certain classes (In-service teacher mentor 2).

Subject knowledge and familiarity with school practices and pupils were leveraged in school development. The in-service teachers could, for example, provide the student teachers with information about the pupils' progress in individual subjects. Teacher educators, on the other hand, stated that they were unfamiliar with the schools' practices or with pupils:

> I can use technologies quite well and so on, but then again, this student had a really great idea about how to integrate it into primary education which is a very big challenge (refers to selecting context-sensitive pedagogical solutions) (Teacher educator 1).

Teacher educators were aware that school development is contextual and therefore emphasised the student teacher's and in-service teacher's respective roles in co-development (cf. Midtsundstad and Langfeldt 2020). Diversity in the community members' competences creates possibilities for each of the members to contribute in a different way to the common goal (Wenger 1998). In this case, the stakeholders seemed to have clear perceptions about their own and each other's expertise in relation to their negotiated goal.

Discussion and conclusion

Regarding the first research question: 'Which characteristics of a CoP can be recognised in the Primary School Teacher Education practicum?', the results revealed that according to the stakeholders, the practicum included several practices that to some extent support the CoP concept including the five criteria: *negotiated goal*, *addressed challenges*, *co-development of the community*, *leveraged individual's expertise*, and *regular and intentional interaction*. However, there was a clear mismatch between the instructional documents and the interviewed stakeholders' perspectives. The instructional documents consisted of only a few superficial characteristics concerning co-development and lacked directions

that would encourage stakeholders to 'do things together'. On the other hand, most of the interviewees perceived that co-development did exist in the practicum. Characteristics supporting the idea of a CoP should be made tangible in such documents because they could provide tools for the individuals involved in the practicum to reflect on their practices and collaborate more efficiently. (cf. Wenger 1998).

There is still a need to think more about the teacher educator's role as part of the community created in the practicum. The two teacher educators took part in the negotiations for the practicum's common goals but were not actively involved in the actual co-development processes in the school context. They were instead involved in co-development from a distance by commenting on or proposing actions (cf. Tuhkala 2019). The in-service teacher mentors' role was described in some cases as more of a prospector than a co-developer. Closer collaboration with the student teachers concerning, for example, lesson planning, could result in deeper learning for the in-service teacher and in more ways to contribute to the common goal (cf. Wenger 1998). The use of technological tools or applications to build a platform for interaction could support all stakeholders' involvement in co-development of the school since their physical presence is not always possible.

The second research question was: 'How do the stakeholders perceive digital pedagogy in the context of practices for co-development?'. The results revealed that the co-development projects were related mostly through their use of various technologies in teaching and through their respective goals being negotiated by the stakeholders. The in-service teacher mentors sought ideas for how to use technologies in different teaching and learning settings, which is closely related to technological pedagogical knowledge. They also expressed that subject or content knowledge was their one area of expertise (cf. Mishra and Koehler 2006). This resulted in areas of expertise being clearly divided among the student teachers and in-service teacher mentors. The student teachers were responsible for planning how to implement technologies in teaching, while the in-service teacher mentors were responsible for the content (cf. Maslin and Smith 2017). Therefore, it was left for the student teachers to determine the effective pedagogical solutions when involving technologies.

The co-development of digital pedagogy mostly occurred at the interaction level and was perceived as making changes in individual lessons for some of the courses. Changes at the course and organisational levels, however, did not take place because the co-development did not impact course planning or lead to any comprehensive changes in school management. Such co-development would require more planning from the in-service teacher mentors in terms of how to involve student teachers and the whole school community at these levels. Therefore, school administrations should acknowledge such practicums as contexts for co-development (cf. From 2017). The levels on which co-development is meant to have an impact could also be discussed in the negotiations for the practicum's common goal(s). This could help the practicum's co-development projects achieve a more comprehensive impact in the schools.

The study revealed that implementing the idea of a CoP in teacher education practicums may provide useful practices for co-development. In this study, the negotiated goals were related to the co-development of digital pedagogy, but future applications can involve other goals as well. This demonstrates that the strategy for implementing a CoP can be transferred to other Teacher Education programs. While implementing this

method, it is beneficial to allow for negotiating the goals among the stakeholders and for discussing each other's' roles at the very beginning of the co-development process. In sum, teacher educators, student teachers, and in-service teacher mentors all have different ways of contributing to their common goals.

This study provides a strategy for implementing the idea of a CoP as part of a teacher education practicum that can connect university personnel, students, and school personnel as they work to achieve common goals. However, it is crucial to consider the fact that teaching practicums are study courses with well-established practices and regulations affecting the behaviour of the actors involved. Thus, further research is needed to formally examine and evaluate the roles of student teachers, in-service teacher mentors, and teacher educators in teaching practicums. Moreover, this case study has identified a need for an examination of the connections between the practices supporting the idea of Wenger's (1998) CoP and the learning of stakeholders involved in the practicum. This examination could yield a better understanding of the benefits of a CoP used in teacher education and school contexts.

Limitations

Construction of validity concerning reliability and replicability is raised as one issue related to case studies and qualitative research methods in general (Yin 2014). This case study sought to address this issue through the adoption of systematic procedures concerning case studies (Yin 2014) and careful reporting practices. One issue of this case study is that the results may not be transferable. The strategy for implementing the idea of CoP in Teacher Education however can be. The CoP was merely used as a perspective from which the practices for co-development among different stakeholders could be examined. Theoretical premises played a focal part in this study, which is a characteristic of deductive content analysis.Mishra

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Notes on contributor

Janne Väätäjä is a PhD candidate and he works as a researcher within the Faculty of Education at the University of Lapland. His research interests are in technology-enhanced teaching and learning.

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Sub-Study III

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ARTICLE

Exploring the conceptions of meaningful digital pedagogy in the context of teacher education practicums

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Abstract

Technology integration in teacher training is paramount to adequately prepare student teachers for their future working lives. However, the integration of technology for pedagogical purposes in teacher training is sometimes problematic. The purpose of this study is to identify variations in the features related to meaningful digital pedagogy. This study is aimed at developing practices and pedagogy regarding technology use during teacher education practicums. Another objective of the study is to support the collaborative planning of digital technology inclusion in teaching by student teachers, their supervising in-service teachers and university teacher educators. Data were collected through interviews and analysed with a phenomenographic methodology. The findings indicate that teacher education practicums are commonly perceived as a context for reciprocal learning, wherein participants engage in mutual learning situations. Simultaneously, meaningful digital pedagogy is considered to adopt a student-centred perspective on learning. The findings are reflected through a theoretical framework, which consists of a learning community approach and the Technology Integration Matrix (TIM). This study contributes to the pedagogical development of the teacher education practicum and provides a perspective on aspects of how to implement a collaborative approach in the teacher education curriculum, thereby facilitating the implementation and development of new practices in teacher education practicums.

Keywords: meaningful digital pedagogy, teacher education practicum, Technology Integration Matrix, phenomenography, learning community

Introduction

There has been great interest in and a need to integrate digital technology in Finnish primary school education, and, consequently, in teacher education over the last decade (Kimav and Aydin, 2020; Lähdesmäki and Valli, 2018). Although technological competence is essential in the digitised world, both in working life and generally to function as an active citizen of society, technology integration in teacher education seems problematic, rendering it questionable whether student teachers are adequately prepared for their future working lives (Li, 2021; Ngao, Sang and Kihwele, 2022). Ample research about student teachers' perspectives concerning teacher education practicums has been conducted (Çapan and Bedir, 2019; Mukeredzi and Manwa, 2019; Wang and Apraiz, 2018). A study by Ngao, Sang and Kihwele (2022) found that student teachers were willing to use digital technologies in their teaching. However, simultaneously, some university teacher educators lacked an understanding of the rationale behind the use of technology and questioned its application in their teaching methods. Furthermore, the study revealed that equipment limitations, heavy teaching workloads and time constraints were significant barriers to incorporating technology into teaching and learning activities. University teacher educators employed various software and online platforms, including social media and journal subscriptions, to access learning materials. However, the pedagogical use of technology was missing (Ngao, Sang, and Kihwele, 2022). This scarcity corroborates the findings of Amhag, Hellström and Stigmar (2019), which revealed that teacher educators did use digital technology, but not primarily for pedagogical purposes. The poor integration of technology for pedagogical purposes in teacher education and the need for new ways to equip student teachers with adequate digital competence for their future were also noted by Amhag, Hellström and Stigmar (2019).

The observation of teacher educators' utilisation of technology in their work could have a substantial impact on the student teachers' professional development and future teaching practices (Ngao, Sang, and Kihwele, 2022). This view is consistent with a study by Tondeur et al. (2019), which also found teacher educators' roles significant in the preparation of student teachers for the educational use of digital technology. However, it is a challenging task for teacher educators to equip student teachers with the necessary competence to effectively integrate technology into their future teaching methods, highlighting the importance of continuously updating one's competence in the pedagogical use of educational technology (Amhag, Hellström and Stigmar, 2019; Tondeur et al., 2019). Notably, mere integration of digital technologies into teaching does not guarantee an improvement in the learning process. There is a potential correlation between students' weaker learning outcomes at the age of 15 and the increased prevalence of self-directed learning practices and frequent utilisation of digital learning materials (Saarinen, 2020). This correlation promotes the need to conceptualise meaningful digital pedagogy.

The practicum periods during student teacher training provide an opportunity to explore and develop prospective teachers' professional identities and competences (Anspal, Leijen and Löfström, 2019; Väätäjä, 2023; Väätäjä and Frangou, 2021). Simultaneously, the collaboration among universities, which are known for their theory and research-oriented environment, and schools, which focus on structured learning, has proven to be advantageous in facilitating opportunities for reciprocal learning

among student teachers, in-service teachers and teacher educators (Heikonen, Toom, Pyhältö, Pietarinen, and Soini, 2017; Kyllönen, 2020; Resch, Schrittesser, and Knapp, 2022; Väätäjä, 2023; Väätäjä and Frangou, 2021). Hence, the practicum provides an opening for technology integration in a collaborative way, in which the teacher educators, in-service teachers and student teachers can combine all parties' strengths, linking theoretical backgrounds with technological choices during the practicum while learning with and from each other (Väätäjä, 2023; Väätäjä and Frangou, 2021). The teacher education practicum, therefore, also provides opportunities for in-service teachers to learn from student teachers, and can therefore be considered a learning environment for in-service teachers and teacher educators (Kyllönen, 2020; Helin, 2014).

The research contributes to the field of teacher education by responding to the need for more research on technology integration in teacher education and the collaborative development of the practicum periods of teacher training. Hence, the findings provide important perspectives for teachers, teacher educators and teacher education curriculum developers that embrace equality and engagement throughout the collaborative practicum process related to meaningful digital pedagogy. This study contributes to the pedagogical development of the teacher education practicum and provides perspectives on how to implement a learning community approach in the teacher education curriculum and, thereby, the practicum, hopefully leading to the implementation of new practices.

Theoretical Framework

This study employed the concepts of learning communities and the Technology Integration Matrix (TIM) (Harmes, Welsh, and Winkelman, 2016) to reflect on and theorise about the practices for collaborative and meaningful use of digital technologies as part of the teaching process. The TIM was used in this research because it provides both characteristics of meaningful learning environments and levels of technology integration. The background of the study arises from the need to identify ways to develop technology-enhanced pedagogy that encourages student teachers, their supervising in-service teachers and university teacher educators to engage in lifelong collaborative learning. Generally, the learning community implementations share the common feature that they are employed as an approach in different settings to achieve social interaction and collaboration for improving teaching and student learning (Akiba and Liang, 2016; Doğan and Adams, 2018; Stoll et al., 2006; Vescio et al., 2008). In this study, the learning community refers to a group of individuals with the common goal of enhancing their knowledge, skills and understanding in a particular subject or field.

Learning communities can take various forms, from traditional classroom settings to online platforms and informal gatherings. Their primary aim is to create an environment in which participants can engage in collaborative learning, share ideas, exchange experiences and support each other's learning journey (Næsheim-Bjørkvik, Helgevold and Østrem, 2019; Polly, Heafner, Chapman, Spooner, 2014; Pont, Nusche, Moorman and Hopkins, 2008; Robinson, Lloyd and Rowe, 2008). The teacher education practicum provides the context for the learning community, which involves student teachers, teacher educators from universities and in-service teachers from university training schools. Furthermore, considering the cultural context is crucial when embracing a learning community approach. Culture

plays a significant role in shaping people's beliefs, values, communication styles and learning preferences. Adapting a learning community approach to the cultural context ensures that the community is inclusive, effective and respectful of diverse perspectives (Pan and Cheng, 2023). The active and collaborative learning perspectives are also recognisable within the TIM framework. The TIM theorises the meaningfulness and depth of technology integration and provides five interconnected and broad characteristics for meaningful learning environments. The matrix was created by the Florida Center for Instructional Technology and is an educational framework used to assess the integration of technology in teaching and learning processes. The TIM helps educators, administrators and policymakers understand how technology is being utilised in the classroom and how it can enhance different aspects of instruction (Harmes, Welsh and Winkelman, 2016).

First, the TIM represents the characteristics of learning environments, focusing on the classroom environment, and describes how technology is utilised within different instructional settings. The TIM comprises five characteristics of meaningful learning: active, constructive, authentic, collaborative and goal-directed. *Active* use of technology by students involves using it as a tool rather than passively receiving information from it. When students demonstrate *constructive* use of technology, they employ technology to connect newly acquired information with their existing knowledge. *Authentic* usage of technology means students apply technological tools to relate their learning activities to real-life situations. The *collaborative* aspect entails students using technological tools to collaborate rather than work in isolation. Being *goal-directed* with technology involves using it to set objectives, plan activities and reflect on the entire learning process (Harmes, Welsh and Winkelman, 2016).

Second, in the TIM framework, the levels of technology integration represent a continued use of technology in the learning process, from minimal integration to seamless integration. The five levels are presented as follows: 1) entry level, 2) adoption level, 3) adaptation level, 4) infusion level and 5) transformation level. The *entry level* is the point at which technology is occasionally utilised and often lacks a distinct connection to the curriculum. Technology might be used as a supplementary tool or a reward. At the *adoption level*, technology is employed as a direct tool to support specific learning objectives. Technology is often seen as a substitute for traditional instructional methods. The *adaptation level* is the point where technology use becomes more frequent and educators begin to modify instructional strategies to better align with technology tools. Technology becomes an integral part of the learning process at this level. At the *infusion level*, technology is infused throughout the curriculum and its use is seamless with learning activities. Technology enhances and transforms the learning experience at this level. At the *transformation level*, technology is utilised to encourage pupils to make innovative use of technologies to facilitate higher-order learning activities, which may not be possible without the use of technology (Harmes, Welsh and Winkelman, 2016). Säljö (2010) agrees somewhat with the profound idea of TIM by stating that technologies not only aid learning but also actually change the way we learn and understand the learning process.

In conclusion, the TIM and the learning community approach combine collaborative practices, meaningful learning and technology integration levels, offering descriptions of their characteristics and thus providing a fitting theoretical background for this study.

Research questions

It is against this background that we seek to identify features related to collaborative and meaningful digital pedagogy during the teacher education practicum. Hence, our objective is to develop the practices and pedagogy of the teacher education practicum that support collaborative planning of digital technology integration in teaching by student teachers, their supervising in-service teachers and university teacher educators. Therefore, the teacher education practicum provided a fitting context for conducting this research involving collaborating and reflecting in authentic real-life settings, establishing a place for collaborative learning.

In this study, we examine the experiences of university teacher educators, student teachers and in-service teachers and ask the following research questions:

1. *What meanings do participants attribute to the collaborative practices in the teacher education practicum?*

2. *What are the participants' conceptions of meaningful digital pedagogy in the context of the teacher education practicum?*

Methodology

Phenomenographic research

The study is conducted following a phenomenographic research approach, which is grounded on the premise that there are a limited number of logically related ways to experience, understand or conceptualise a particular phenomenon (Marton, 1981; Marton and Booth, 1997; Marton and Pong, 2005). In this study, however, the term 'conceptualise' is used instead of 'experiencing' or 'understanding' because the focus lies on conceptual features rather than sense-related features. In this study, 'conception' is the unit of description (Marton and Pong, 2005). Conceptualising collaborative practices and meaningful digital pedagogy within the context of teacher education practicum is a multifaceted social phenomenon defined by diverse domains of expertise, all within the backdrop of swiftly evolving digital and educational landscapes. For these reasons, phenomenography serves as a fitting research approach (Marton and Pong, 2005; Sin, 2010).

Participants and context

This study involves participants from school and university organisations. The participants of this study were student teachers (N=8), supervising in-service teachers (N=4) and university teacher educators (N=4) involved in guided advanced practicum, which is a part of the Primary School Teacher Education Curriculum of the University of Lapland. The guided advanced practicum is completed at the University of Lapland's teacher training school, and it is worth seven European Credit Transfer and Accumulation System (ECTS) credits. Student teachers complete five practicum periods during their five-year study, one practicum per year. The student teachers participating in this study had just finished their fourth year's practicum period, and the interviews were conducted in the small groups in which the student teachers had worked throughout the practicum for mentoring and support. The interviews were organised in conjunction with the groups' final reflective meeting. The fourth practicum period provided

a suitable context for this research because the student teachers have accumulated enough experience to discuss aspects related to not only teacher education practicum but also pedagogical issues.

In Finland, teacher training schools are administratively part of the faculties of education and have several duties. These duties encompass providing education for both comprehensive and upper secondary levels, mentoring and supervising student teachers, nurturing their pedagogical skills and preparing them for the demands of the profession. Teacher training schools also delve into teaching experiments and research, contributing to the development of innovative teaching methodologies. The duty of teacher training schools is to offer in-service education to educators, ensuring that teaching staff remain updated and equipped with the latest knowledge and techniques in the ever-evolving field of education (FTTS, 2023). In-service teachers involved in the study are working in the field of education, specifically in the University of Lapland's Teacher Training School. Each teacher was responsible for supervising two student teachers during their practicum period and providing important experiential knowledge and perspectives on how to meet the real-world challenges of working life. University teacher educators are faculty members who are responsible for training and supervising student teacher during practicum periods but also throughout their studies. Their insights are important for understanding the academic and theoretical aspects of teacher preparation and pedagogy.

Data collection

In this study, we use group interviews as a data collection method, in which participants collectively discuss collaborative practices and meaningful digital pedagogy in the context of teacher practicum. In total, there were four individual group interviews. Each of the groups consisted of two student teachers, one university teacher educator and one supervising in-service teacher. Each of the groups was interviewed once. In this study, a semi-structured interview design (Wilson, 2016) was employed to enhance the conversational quality of data collection. This approach allowed for slight adjustments to interview questions and asking follow-up questions, thereby reducing the risk of omitting valuable information from the study (Wilson, 2016). The interviews maintained the same structure for all four group interviews. Semi-structured questions provided consistency for researchers to compare the insights and perspectives of these different groups. At the University of Lapland, the student teachers work in pairs during the practicum and are assigned one university teacher educator and one in-service teacher from the school to supervise and support them during the practicum period.

The interviews consisted of two parts. The questions in the first part of the interview were related to the collaborative practices among the university teacher educators, in-service teachers and student teachers in the context of teacher education practicum. The questions in the first part were formulated as follows:

1. What kinds of collaborative practices do you implement in teacher education practicums?

2. How did these collaborative practices support the development of your competence?

3. What is the meaning of these collaborative practices?

4. What other means can you propose for collaboration and enabling learning experiences for all of you?

5. How do you view the teacher education practicum?

The second part included questions about meaningful digital pedagogy. The questions related to this part were formulated in such a manner that participants could discuss what makes the use of digital technologies meaningful in educational settings. The questions for the second part were formulated as follows:

6. What does digital pedagogy mean to you?

7. What makes digital pedagogy meaningful?

8. What factors make the use of technology in teaching meaningful?

9. How has your digital pedagogical competence developed during the practicum period?

10. How could the teacher education practicum serve as a context for co-developing digital pedagogy?

Phenomenographic research typically involves collecting data through interviews, observations or written accounts (Marton and Pong, 2005). The researcher seeks to elicit participants' experiences, perceptions and understandings related to the phenomenon of interest. Open-ended questions and prompts are often used to encourage participants to reflect on their experiences in depth and provide rich descriptions. The interview questions were selected to create a conversational atmosphere in which participants could freely share their ideas and approach the topic at hand. Each of the interviews lasted 30–40 minutes. Table 1 represents the lengths of the individual group interview transcriptions.

Table 1: Length of the individual group interview transcriptions

Group participants	Length of the material
Group 1 ● student teacher 1 ● student teacher 2 ● in-service teacher 1 ● university teacher educator 1	5020 words
Group 2 ● student teacher 3 ● student teacher 4 ● in-service teacher 2 ● university teacher educator 2	5177 words
Group 3 ● student teacher 5 ● student teacher 6 ● in-service teacher 3 ● university teacher educator 3	3546 words

Group 4 • student teacher 7 • student teacher 8 • in-service teacher 4 • university teacher educator 4	4167 words
Total	***17910 words***

The group interviews were audio recorded by phone and later transcribed verbatim. Recorded audio files were stored on a personal OneDrive for Business folder, which is provided by the University of Lapland to its personnel. The stored data were encrypted to guarantee the anonymity of the participants.

Data analysis

The data analysis is conducted following a qualitative phenomenographic analysis process, which involves categorising the conceptions and uncovering the underlying structures that give rise to those experiences (Svensson, 1997). Rather than aiming to generalise findings or establish cause-and-effect relationships, phenomenography seeks to uncover the qualitatively distinct ways in which individuals conceptualise a phenomenon. These ways, known as conceptions, form a hierarchical relationship where more complex conceptions build upon simpler conceptions. The goal of phenomenography is to identify and describe these conceptions, providing insights into the range of possible conceptions within a particular context (Marton and Pong, 2005; Svensson, 1997). The study employs an inductive approach, commencing with a collection of observations and subsequently progressing from these specific experiences to a more general set of propositions about those conceptions.

The researcher engages in a systematic process of categorisation, grouping participants' responses based on similarities and differences in their conceptions (Marton and Pong, 2005; Svensson 1997). This process involves examining the underlying structures and relationships between the categories, with the aim of developing a comprehensive conceptualisation of the variation in experiences. Next, to determine the variation in the conceptions of student teachers, supervising in-service teachers and university teacher educators about meaningful digital pedagogy and collaboration with each other in the context of teacher education practicum, the data were interpreted and coded into units of description. Categories of description were identified by sorting and re-sorting the individual units. The aim was to transcend various ways of conceptualising the phenomenon into more overarching themes to illustrate how awareness expands along the given theme when transitioning from less comprehensive ways to more comprehensive ways of encountering the phenomenon (Åkerlind, 2018). The NVivo qualitative data analysis software was selected to assist in the coding and categorisation processes.

One of the key outcomes of phenomenographic research is the development of an outcome space, which represents the hierarchical relationships among the identified conceptions. The outcome space provides a visual representation of the different ways in which individuals conceptualise the phenomenon, with the more complex conceptions located at higher levels of the hierarchy. This outcome space serves as a theoretical framework for understanding the phenomenon and can be used to inform future research and educational practice (Åkerlind, 2005). This chapter has provided an

overview of the phenomenographic research methodology employed in this study, its key principles and its application in exploring the different ways in which individuals conceptualise collaborative practices and meaningful digital pedagogy in the context of teaching practicum. The following will delve into the findings and implications derived from this phenomenographic analysis, contributing to a deeper understanding of the phenomenon and its implications for practice.

Results

The results indicate that collaborative practices offer opportunities for the development of meaningful digital pedagogy in the context of teacher education practicum. Figure 1 summarises the results provided by the phenomenographic analysis.
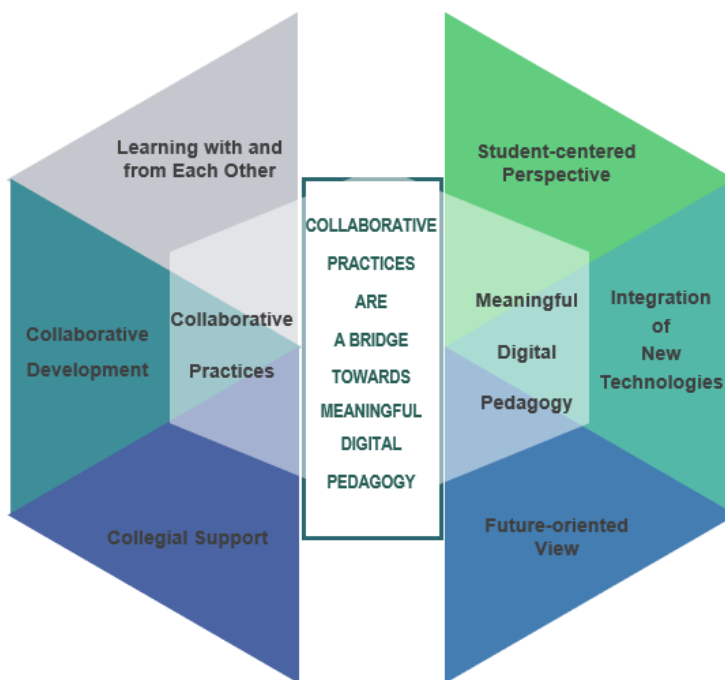

Figure 1. Findings from research questions 1 and 2.

The categories formed by the phenomenographic analysis and the answers to the research questions are presented in this section. The first research question is presented as follows: "*what meanings do participants attribute to the collaborative practices in the teacher education practicum?*" To answer this question, the relevant items regarding the research topic were identified and consequently clustered in categories (Table 2). These categories are combined with the findings of research question 2 in Figure 1.

Table 2: Outcome space of collaborative practices among university teacher educators, in-service teachers and student teachers in the context of teacher education practicum

Väätäjä: Co-development of meaningful digital pedagogy

Units of description	Description of category	Number of references in the data
- Reflective conversations - Strategies to support well-being and improve job satisfaction - Collaborative reflection - Increased confidence - Efficient lesson planning	Context for learning with and from each other	16
- Importance of thoughtful implementation - Research-based decision-making - Supportive environment in which educators can experiment with different methods	Context for collaborative development	11
- Equality - Respect and appreciation of each other's expertise - Broader educational dialogue, such as discourse on teachers' professional identity development	Context for collegial support	8

Learning with and from each other

The category includes the idea of engaging in reflective conversations with student teachers and discussing their strengths, areas for development and significant learning experiences during practicum periods.

> I feel that practicum is a platform where student teachers, when they come to school, learn a lot from their more experienced colleagues. But the experienced colleagues also learn from the student teachers. (In-service teacher 4)

Additionally, the in-service teachers mention their own involvement in various educational projects and collaborations with colleagues, which allows them to bring their own interests and strengths into the teaching practice and contribute to the growth of the students and the overall team (cf. Harmes, Welsh and Winkelman, 2016; Næsheim-Bjørkvik, Helgevold and Østrem, 2019). The conversation touches on the significance of teachers' well-being and work-life balance.

> Coping on the job is incredibly important because it is also related to staying in the field that is, what is our teachers' well-being at work, what things affect it, what burdens it and how could it be made easier? (In-service teacher 3)

The participants highlight the importance of addressing factors that affect teachers' well-being and suggest strategies to alleviate workload and improve job satisfaction.

Context for collaborative development

The context for collaborative development includes the idea of engaging in discussions about various aspects of teaching, including assessments, well-being, cooperation with parents and the broader responsibilities of being an educator. The value of reflecting on teaching practices and exploring ways to continue improving and developing as professionals is emphasized.

In general, about the day, what has happened, the kind of situations there have been with the pupils, and then, in general, all things related to the teacher's work, like evaluations, coping at work and cooperation with the pupils' parents, and really extensively, everything about this job, is related. (Student teacher 1)

The participants who share this view understand practicum as a context to collaborate and develop pre-existing teaching practices. They highlight the importance of having space and time for experimenting and learning from them.

Context for collegial support

The context for collegial support encompasses the idea of a significant difference when all of the participants of the practicum feel welcome and emphasises the importance of a respectful atmosphere and appreciation of each other as teaching professionals.

Yes, I think we have quite different points of view, but we are all on an equal footing here, discussing our areas of expertise and learning from each other. (University teacher educator 2)

The participants who share this view understand practicum periods as platforms for collegial support, where members from different backgrounds are accepted for who they are. During the practicum periods, the participants discuss the challenges faced by teachers in participating in public discussions and influencing educational policies. They mention the possible limitations of teachers in speaking openly due to potential repercussions, despite their desire to contribute their insights and experiences to the broader education dialogue (cf. Pan and Cheng, 2023).

Regarding technology integration into teaching and learning during the practicum, the second research question is presented as follows: "*What are the participants' conceptions of meaningful digital pedagogy in the context of teacher education practicum?*" The participants' conceptions regarding this topic have been categorised and quantified in Table 3 and combined with the findings of research question 1 in Figure 1.

Table 3: Outcome space of meaningful digital pedagogy

Units of description	*Description of categories*	*Number of references in the data*
● *Personalised learning experiences* ● *Engagement and collaborative learning with technology* ● *Instructional support with technology* ● *Redefined roles of teachers and students*	*Student-centred perspective*	*16*
● *Necessary digital skills for the future* ● *Employability*	*Future-oriented view*	*12*

● *Enhancement of traditional pedagogical approaches* ● *Utilising digital tools for interaction* ● *Creating a bridge between school and home*	*Integration of new technologies*	*8*

Student-centred perspective

The first category, the *student-centred perspective,* encompasses the idea that meaningful digital pedagogy should adopt a student-centred approach, considering the students' preferences and prior knowledge when selecting digital tools and platforms.

> They (digital tools) can be used to increase pupils' well-being. For example, if a pupil comes up to me and says that reading is difficult for them, I can suggest listening to the ebook. There is no better way to create value than by using them. (University teacher educator 2)

> Using familiar platforms allows the teacher to focus on the lesson's content while avoiding spending too much time teaching pupils about the tool's functionalities. (Student teacher 3)

The participants who share a *student-centred perspective* understand meaningful digital pedagogy as a means to make learning engaging and accessible by using digital tools. The participants also highlight that the use of digital tools with which pupils are already familiar reduces the need for extensive teaching of new technologies during the lessons. According to the participants, there is also a significant shift in teaching practices in classrooms that embrace digital tools compared to those that do not (cf. Harmes, Welsh and Winkelman, 2016; Säljö, 2010). The participants who share this view emphasise how digital pedagogy fosters collaborative learning, creative expression and more personalised learning experiences, enhancing both student and teacher engagement.

> For pupils to achieve the learning objectives, it is important that we provide them with versatile tools that will allow them to be creative and collaborate. (In-service teacher 1)

> I want to be more than a talking head behind the screen, which is why I am interested in the possibilities of digital tools regarding collaborative learning. (University teacher educator 1)

The participants who share this view believe that the value of digital pedagogy lies in the innovative teaching practices it enables rather than the technology itself.

Future-oriented view

The second category, the *future-oriented view,* encompasses the general idea that meaningful digital pedagogy is understood as a means to prepare students for the future by equipping them with essential digital skills. The participants emphasise the importance of introducing students to various digital tools and platforms, which are commonly employed in the current workforce, to enhance their employability and adaptability in the ever-changing technological landscape.

> I feel that we need to ensure that pupils become familiar with different kinds of digital platforms already in schools to provide them with a good foundation for working life and those future skills. (In-service teacher 1)

The participants who share this view emphasise the societal significance of incorporating digital pedagogy to address rapid global changes and ensure that students are equipped with relevant skills and knowledge. The participants who share this *future-oriented view* avoid creating dichotomies between "normal" or "traditional" pedagogy and digital pedagogy. They aim to seamlessly blend both approaches and avoid presenting them as conflicting or mutually exclusive options (Redecker and Punie, 2017).

Technological integration

The third category, *technological integration,* encompasses the idea that digital pedagogy is an integral part of modern teaching practices, considering it as a tool that enhances traditional pedagogical approaches rather than a separate teaching method. The participants aim to seamlessly integrate technology into their teaching, maintaining a balance between traditional and digital teaching methodologies.

> The use of digital tools should not be understood as a requirement in every lesson but should be utilised to the extent that they support learning. (In-service teacher 3)

> The teaching should be goal-oriented, so if some digital tools can help me go towards that goal, then it is indeed in the right place at the right time. (Student teacher 2)

The participants who share this view did not consider that the use of digital tools would necessarily affect a change in teaching practices. The participants mentioned that various digital tools and platforms can be used, for example, to create engaging language learning activities, such as word games and reading exercises (cf. Harmes, Welsh and Winkelman, 2016). Such activities can also be implemented without using digital tools. The findings provide evidence that digital tools can be used as part of pre-existing teaching practices. This view also emphasises that digital pedagogy can help create a bridge between school and home.

> We have tried to more efficiently use digital tools such as Wilma to inform guardians about what has been accomplished here and what has been carried forward in digital pedagogy so that they can understand that, for example, mobile phones can be used for reasonable learning activities. (In-service teacher 1)

This view also emphasises that, by leveraging technology, it is possible to create and implement interactive environments to reduce the time spent on mundane administrative tasks and allow for more meaningful interactions with pupils and their guardians.

These distinct ways of understanding digital pedagogy showcase the diversity of perspectives and the varied implications of digital pedagogy on teaching practices, student learning experiences and overall educational goals. Educators' backgrounds, experiences and teaching contexts play a significant role in shaping their interpretations and applications of digital pedagogy.

Discussion, limitations and conclusions

The conceptions of student teachers, supervising in-service teachers and university teacher educators regarding the teacher education practicum reveal the significance of the collaborative work during the

practicum for all involved, which is consistent with the concept of a learning community (cf. Næsheim-Bjørkvik, Helgevold and Østrem, 2019). The findings are also consistent with the TIM framework's five characteristics of meaningful learning: *active, constructive, authentic, collaborative and goal-directed* (Harmes, Welsh and Winkelman, 2016). However, in this context, the involvement of technology is more vaguely discussed. The participants appreciated that the teacher education practicum provided a context for the participating members to *actively* learn with and from each other (Heikonen, Toom, Pyhältö, Pietarinen, and Soini, 2017; Kyllönen, 2020; Resch, Schrittesser, and Knapp, 2022; Väätäjä, 2023; Väätäjä and Frangou, 2021). The things everybody can learn are related to efficient and *constructive* lesson planning, developing strategies to support well-being and improving job satisfaction. The second most shared idea was that the teacher education practicum is a *goal-directed* context for *collaborative* development. The goal is to develop one's digital pedagogical skills, pedagogical competence and teacher's professional identity. *Collaboration* is related to research-based experimentation and collaborative supervision, which can result in changes in *authentic* classroom practices and experimentation with new methods and technologies (cf. Akiba and Liang, 2016; Doğan and Adams, 2018). The third and least shared conception was that the teacher education practicum is a context for collegial support, in which all of the participating members should be considered equals, which makes it possible for them to discuss, for example, matters related to their profession in the future and the *constructive* development of working conditions. Having this kind of discussion enables them to understand and participate in the broader national discussion about the future of the teaching profession.

Digital pedagogy is subject to varying interpretations among educators. For certain individuals, digital pedagogy entails the refinement of pre-existing instructional approaches. Conversely, others perceive digital pedagogy as a means to facilitate a more holistic advancement of the learning process, entailing a re-evaluation of the roles assumed by both educators and learners (cf. Säljö, 2010). Furthermore, there exists a viewpoint positing that digital pedagogy holds a broader significance, particularly concerning the preparation of young individuals for the future. This significance pertains to their imperative need to acquire proficiency in navigating novel technological tools, even those that are not inherently pedagogical in nature. The conceptions of student teachers, supervising in-service teachers and university teacher educators regarding meaningful digital pedagogy reveal the diversity of digital competence that will be required of future teachers. Teachers are teaching the workforce of tomorrow's society, which necessitates future-oriented and student-centred approaches in the classroom. It seems that teachers need to have the competence to switch between all the levels of the TIM framework—*entry level, adoption level, adaptation level, infusion level and transformation level* (Harmes, Welsh and Winkelman, 2016)—in order to provide meaningful, active, participatory and motivating learning experiences to the learners involved in the practicum. Most of the participants conceptualise meaningful digital pedagogy as a student-centred perspective on teaching that enables them to create personalised learning experiences, embrace engagement with technology and enhance instructional support with technology. The second most common conception was that meaningful digital pedagogy is about having a future-oriented view that is not only related to enhancing teaching practices but also provides pupils with the necessary basics for them to be able to navigate the digitalised world of the future. The

participants shared the view that they have to provide pupils with skills that will help them learn future technologies.

The particular strength of this study is its methodology, as phenomenography allows for an in-depth exploration of individuals' conceptions, capturing the richness and complexity of their understandings. This study provides a holistic view of the collaborative practices and meaningful digital pedagogy in the context of teacher education practicum, incorporating multiple perspectives and allowing for the identification of patterns and relationships. Furthermore, phenomenography can contribute to the development of educational practices and interventions by highlighting the different ways in which learners understand and engage with a subject. Although the findings of this study contribute to a good understanding of the conceptualisation of collaborative practices and meaningful digital pedagogy in the context of a teaching practicum, it has some limitations. First, the phenomenographic approach requires active engagement and interaction between the interviewer and the interviewees. Thus, it is important to acknowledge that this interaction can sometimes be perceived as a methodological weakness, as it introduces an element of potential interviewer influence. Sin (2010) introduced the following practical considerations for the interviews to minimise interviewer influence, which were followed by the first author. In the interviews, a deliberate effort was made to ensure clear communication. These efforts involved avoiding assumptions about the meanings of interviewees' expressions, opting instead to use follow-up questions for clarification. The researcher refrained from introducing new terms or correcting interviewees and allowed time and space for thoughtful responses while maintaining a neutral facial expression to avoid influencing any interviewees' answers (Sin, 2010.) Second, the interpretation of conceptions and the construction of an outcome space involve subjective judgments by the researcher, which can introduce bias. Therefore, the authors have investigated the data both individually and collaboratively to reduce the potential for individual author's subjective judgements.

In conclusion, teacher education programmes should prioritise providing comprehensive training in digital skills and technology integration to ensure future teachers' ability to change their technology integration level according to the situation at hand and to create the best possible meaningful learning environment for learners, as described by the TIM framework (Harmes, Welsh and Winkelman, 2016). In-service teachers and university teacher educators also need to keep pace with technological developments. This professional development could include workshops, courses and hands-on practice sessions that would be beneficial for ensuring that experienced and inexperienced educators become proficient in using digital technologies for teaching and learning (cf. Ngao, Sang and Kihwele, 2022). The authors state that teacher education practicums provide excellent communities where teacher educators, in-service teachers and student teachers can collaborate, share resources and exchange ideas related to technology integration, which can help them collectively overcome challenges. Thus, it would be beneficial for teacher education curriculum development to consider the possible avenues for university teacher educators and in-service teachers to learn and be active actors in the learning community, beyond the learning objectives established for the student teacher. Teacher education practicums have the potential of being more than merely a study course for student teachers.

This research contributes to knowledge by highlighting the important role that collaboration during the teaching practicum plays in teacher education. This paper reveals the importance of teamwork and reciprocal learning and the significance of meaningful digital pedagogy. Hence, the findings add to the literature on teacher training and provide important perspectives for teachers, teacher educators and teacher education curriculum developers that embrace equality and engagement throughout the collaborative practicum process, which will hopefully leads to the implementation of new practices.

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