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The search for professional digital competence in Swedish teacher education policy—A content analysis of the prerequisites for teacher educators’ dual didactic task

Maria Lindfors¹* and Anders D. Olofsson¹

Abstract: This study is an exploration of the prerequisites in Swedish teacher education policy for teacher educators’ dual didactic task of developing student teachers’ professional digital competence to such a level that they are capable of developing K–12 pupils’ adequate digital competence. Data were collected from 20 Swedish teacher education institutions offering teacher education programs in which student teachers could earn the degree of Master of Arts in Primary Education for School Years 4–6. Overall, the data comprised national guidelines and curriculum regulations for teacher education in Sweden (e.g. the Swedish Higher Education Ordinance; N = 1), program syllabi at the selected teacher education institutions (N = 20), and course plans (for all 240 ECTS, 4-year full-time studies; N = 450), in total N = 471 policy documents. Signs of professional digital competence in policy were few, and most were found in the course plans for mathematics and natural sciences. In the discussion, findings are problematized in relation to the

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PUBLIC INTEREST STATEMENT

This study is an exploration of to what extent, and with what intentions, formulations concerned with student teachers’ development of professional digital competence (PDC) appear in policy documents steering Swedish teacher education (TE). Moreover, how they set prerequisites for teacher educators to fulfill their dual didactic task of developing student teachers’ PDC to such a level making prepared for this coming working-life. A four-dimensional understanding of PDC was used as a theoretical framework - (1) generic digital competence (GDC), (2) subject-didactic digital competence (SDDC), (3) profession-related digital competence (PrDC) and (4) transformative digital competence (TDC). The findings showed that PDC does not have a prominent place in the steering documents. Most common were GDC and SDDC. Signs of PrDC were few, and signs of TDC were non-existent. Findings that to a high degree echoing the international body of research in this field and call for additional efforts in addressing PDC in TE.
challenging role of teacher educators as second-order teachers seeking to fulfill their dual didactic task.

Subjects: Teachers & Teacher Education; Education Policy & Politics; Education Studies

Keywords: teacher education; teacher education policy; professional digital competence; teacher educators; dual didactic task

1. Introduction

In many parts of the world, children are growing up in a digitally infused society (Livingstone et al., 2023). From a global educational perspective, this means that “the chances the general public have of accessing technology and making good use of it for active citizenship in their daily lives” (Gisbert Cervera & Caena, 2022, p. 452) need to be considered. This, in turn, means that a society’s educational institutions in a digital era must educate and enable future citizens to develop multi-dimensional digital competence and apply it in a situated and flexible way (cf. Olofsson & Lindberg, 2021). In broad terms, digital competence can be said to include how to use digital technology, such as laptops and mobile phones, as well as a critical understanding of, for example, the logic behind artificial intelligence algorithms and an ability to detect fake political news and deep fakes spread on the internet (Ortegaen, 2023, Vuorikari et al., 2022). Digital competence in this sense becomes a question about not only technology but also democracy and digital citizenship (Choi, 2016, Choi & Cristol, 2021). Research here points to the necessity of teachers in K–12 schools knowing how to support pupils’ development of digital competence to allow them to participate in contemporary society (Nagel, 2021; Olofsson & Lindberg, 2021). Moreover, it shows that teacher education (TE) creates the conditions necessary for the next generation of teachers to develop such know-how (Starkey & Yates, 2022).

Acknowledging that young people’s digital competence is a global educational concern and that TE and teacher educators therefore are vital (Andreasen et al., 2022, Jimarkon et al., 2021), this paper reports on digitalization in Swedish TE and Swedish teacher educators’ level of professional digital competence (PDC) (see, e.g., Amhag et al., 2019, Edstrand & Sjöberg, 2023, Erstad et al., 2021, Hanell, 2018, Lindfors et al., 2021, Roumanis-Viberg et al., 2019). More specifically, it focuses on how and to what extent recent TE policy in Sweden supports teacher educators in their dual didactic task to ensure that student teachers develop the PDC needed for their future work lives in increasingly digitalized K–12 schools. In this paper, the dual didactic task is understood as a single task but at the same time a task always closely connected to a teaching object that can differ depending on what subject and content area are targeted in TE training (Lindfors et al., 2021, see also Siddiq et al., 2023). Moreover, it refers to teacher educators’ task of teaching student teachers during their training in TE how to teach in their future classrooms for their pupils’ development of adequate digital competence (see also Olofsson et al., 2020, Skantz-Åberg et al., 2022, Spante et al., 2018).

Empirically analyzing TE policy is also necessary because TE is often considered high on the political agenda when a certain development with strong economic incentives in society is desired or to be prioritized (Jackson & Burch, 2019). Without K–12 schools providing suitable conditions to develop digitally competent citizens, Sweden is a nation at risk of falling behind in global competition (Lindfors et al. 2021). Hanell (2018, 2019) suggested that the current political interest in TE is connected to large investments in digital technology in K–12 schools, in Sweden (cf. Fransson et al., 2018) and elsewhere in Europe (Gabriel et al., 2022).

According to Livingstone (2016), teacher educators are responsible for putting policy into practice and supporting the development of those becoming teachers, but at the same time, one should also acknowledge that such a responsibility must be seen in relation to TE being a part of ongoing changes in school curricula, examination systems, and educational policies more generally (see Lindfors et al., 2021). Livingstone’s (2016) line of argument is important in the
context of this paper, especially given two national educational policies concerning the K–12 schools in Sweden: the National Digitalization Strategy for the Swedish School System (Government Decision 1:1, Supplement to Government Decision, 2017) and the National Plan for Action for the Digitalization of the Swedish School (Swedish Association of Local Authorities and Regions SALAR, 2019). These are policy documents with high relevance to teacher educators’ task of providing opportunities for student teachers to develop PDC in Swedish TE (Gustafsson, 2021).

With this background, our aim for this paper was to investigate the prerequisites in Swedish TE policy for teacher educators to fulfill their dual didactic task of arranging digital teaching and learning practices (cf. Uerz et al., 2018) and developing student teachers’ PDC to such a level that they are capable of creating the necessary educational incentives for K–12 pupils to develop adequate digital competence and be ready to engage in digital citizenship in today’s society (Ortegren, 2023, see also Brianza et al., 2023). To do so, we searched for signs of PDC in national guidelines and curriculum regulations as well as program and course descriptions from 20 TE institutions in Sweden educating teachers of School Years 4–6. The documents were analyzed in two ways: quantitatively and qualitatively. In the latter, we based the framework guiding the analysis on the works by Gudmundsdottir and Hatlevik (2018, 2020) and their descriptions of PDC. This framework is related to the so-called Norwegian Professional Digital Competence Framework for Teachers (Kelentrič et al., 2017), a national document published by the Norwegian Centre for ICT in Education. It covers seven areas defining the teacher’s role in a digital perspective, describing PDC in a TE context (Arstorp & Røkenes, 2022).

However, the rationale for choosing the framework for analysis, building on work by Gudmundsdottir and Hatlevik (2018, 2020), is that it offers an understanding of PDC as comprising four detailed, complex, and interrelated dimensions of digital competence: (a) generic digital competence (GDC), (b) subject-didactic digital competence (SDDC), (c) profession-related digital competence (PrDC), and (d) transformative digital competence (TDC). Thus, the framework can contribute research-informed knowledge about how and to what extent policy documents governing Swedish TE create prerequisites for teacher educators to perform their dual didactic task.

Next, we provide a short review of the literature on digital technology and digital competence in TE, followed by some notes about research on PDC in TE specifically. Then we present the framework on PDC used for our qualitative analysis.

2. Literature review

According to McGarr and Ó Gallchóir (2020), “Most educational technology policy also focuses on initial and continuing teacher education and the importance of effectively integrating technology in teacher education is very prominent in the research literature” (p. 1). Additional international research has reported that in the global educational discourse, TE policy plays a central part in the educational process preceding the graduation of new, digitally competent teachers ready to teach in 21st-century classrooms (Instefjord & Munthe, 2017, Krumsvik, 2014, Voithofer et al., 2019). However, and this may seem a matter of course, intentions in policy might not always be transformed and realized in TE in ways that are as easy and straightforward as expected. For example, Blamire et al. (2017) analyzed 70 research studies in Europe published between 2002 and 2017 and reported few signs of follow-through from the creation of educational policy to the implementation and use of digital technology in TE. McGarr and McDonagh (2019) said a lack of clarity exists in policy on an international level in terms of what digital competence in TE in fact should mean and involve, creating uncertainty in the relationship between policy and practice. A third example is the Danish study by Arstorp (2015), who stated that educational policy concerning digital technology in TE is not directed toward K–12 school practice in the first place but rather functions as guidelines to steer TE in a certain way for society’s benefit. That is, it functions as challenges concerned with what in this paper is understood as prerequisites for teacher educators to fulfill their dual didactic task. Additional challenges have, for instance, been described by McGarr and McDonagh (2019), who argued that vague formulations in TE policy
regarding the use of digital technology and in what ways digital competence shall be conceptualized and developed in TE are challenging. Additionally, in the strand of research investigating how policy and frameworks can be put into practice, from a New Zealand perspective Starkey and Yates (2022) evaluated three international PDC frameworks published in 2017 (the European Union’s DigCompEdu, the International Society for Technology in Education (ISTE) standards, and the abovementioned Norwegian Professional Digital Competence Framework for teachers). The researchers concluded that despite signs of alignment between the frameworks and TE in New Zealand, due to context-specific reasons, it is challenging to adopt a framework that does not “recognise and acknowledge the unique attributes and complexity of their [the New Zealand] education system” (p. 489). In a similar study, Garcia-Vandewalle Garcia et al. (2023) reported on a quantitative study of 176 student teachers involved in TE training in the Spanish autonomous city of Melilla, located in northwest Africa, and their experienced training needs and gaps in digital competence. The analysis was conducted based on the Common Framework for the Digital Competence of Teachers (CDCFT), the Spanish version of the DigCompEdu. The researchers stated that an increased amount of training in digital competence was required for student teachers and that it was important to consider the educational context and the technological, pedagogical, and content knowledge needed to teach in a modern school.

In their literature review, Uerz et al. (2018) said that the low level of alignment between policy and educational practice might have arisen because teacher educators have a low level of digital competence. Tondeur et al. (2016) similarly expressed that teacher educators in general need to be more knowledgeable about how to integrate and use digital technology in teaching and learning activities with their student teachers. Comparably, Pedro et al. (2019) argued that digital technology in TE is in fact often used due to a single teacher educator’s individual enthusiasm rather than as a consequence of policy that subject curricula are compulsory in TE regulations. In a Norwegian context, Instefjord and Munthe (2016, 2017) presented related findings in studies concerning how digital competence is integrated into curriculum documents for TE (e.g., national guidelines, curriculum regulations, and program descriptions). Both studies influenced this study’s design. The main conclusions Instefjord and Munthe (2016, 2017) drew from their two papers are that Norwegian TE curriculum documents do not stress the use of digital technology and that few learning outcomes highlight the integration and use of digital technology. The researchers suggested that digital competence in TE policy is not regarded as an important piece of the puzzle in future teachers’ overall professional competence.

In a Swedish study, Hanell (2018) argued that TE policy needs to change to address in a more trustworthy way the voices from Swedish municipalities about the low level of PDC among newly qualified teachers. Moreover, Hanell claimed a distinct challenge exists in providing pupils in K–12 schools with not only adequate but also quantifiable digital competence (see also Godaert et al., 2022). According to Foulgeri et al. (2017), it is crucial for TE to acknowledge teaching with digital technology throughout the entire TE curriculum by steering the programs in which student teachers are involved (cf. Mohamed et al., 2017). Gudmundsdottir and Hatlevik (2018) added to this by stating that TE is central in helping student teachers develop a realistic understanding of their future work as teachers in digitalized K–12 classrooms (cf. Helleve et al., 2020). Furthermore, Gudmundsdottir and Hatlevik (2018) emphasized the importance of TE, encouraging a bottom-up integration of innovative uses of digital technology and, perhaps even more important, combining it with a top-down governance that facilitates the use of digital technology in TE. Likewise, Graziano et al. (2017) argued institutional leaders having the capacity to drive processes of change related to the use of digital technology in TE is important. Arstorp (2015) also followed this line of thought, arguing that the understanding and use of digital technology in TE should be considered not only an educational or didactic tool in teaching and learning but also a tool on an institutional level in leadership and organization. Put differently, as Tømte and Lazareva (2023) stated, this concept is part of a larger digital transformation of TE that will not only change policies and the role of teacher educators but potentially also cause larger epistemic changes.
3. PDC as a research-based lens for analysis

Research on PDC in TE seems relatively new in the broader field of the digitalization of TE. Gudmundsdottir and Hatlevik (2020) described PDC as a concept being used primarily in the Nordic countries and with more extensive use in Norwegian educational research and practice (see also Olofsson & Lindberg, 2021, Instefjord, 2014). To our knowledge, the Norwegian Institute for Studies in Innovation, Research and Education first coined “professional digital competence” in a national report (Tømte et al., 2013). That report described PDC (in Norwegian, profesjonsfaglig digital kompetanse) specifically as a teacher’s ability to use digital technology in a didactically sound way in teaching and assessment, administrative work, and the evaluation of relevant research (cf. Engeness & Nohr, 2020). Tømte et al. (2013) suggested that at the time of their report, the level of PDC in K–12 teachers was related to existing prerequisites in TE, making it possible for student teachers to develop this competence. According to Gudmundsdottir and Hatlevik (2020), PDC can be considered a central competence in a professional teacher’s everyday work in the classroom. For that reason, according to Lund et al. (2014), TE should be focused on PDC, especially regarding “a mismatch between the digital challenges that newly qualified teachers meet in their profession and the preparations they have received during their teacher education” (p. 282). This seems to be a valid argument according to more recent Norwegian research on TE as well. For example, Lund and Aagaard (2020), Brevik et al. (2019), and Gudmundsdottir and Hatlevik (2018) said that teacher educators have an obligation to educate student teachers in a way that as well as possible assures they will be prepared to handle demanding and multilayered teaching and learning situations in their future classrooms and that PDC is one crucial competence in that aspect.

PDC and its meaning, intentions, and importance for practicing teachers, teacher educators, and student teachers has evolved over time, and we use it in this paper as a research-based lens for analysis. Put differently, after an initial and more quantitatively oriented content analysis of the selected educational policy on Swedish TE, we used the research-based lens for a second analysis to explore to what extent and in what way the policy provides prerequisites for teacher educators to fulfill their dual didactic task of using digital technology in teaching and learning in ways that enable student teachers to develop high levels of PDC. As aforementioned, the specific understanding of PDC builds on the work of Gudmundsdottir and Hatlevik (2018, 2020) and, more precisely, on a combination of their definitions of PDC.

Generic digital competence (GDC) cuts across subjects and specifies the general digital competence that teachers, teacher educators, and student teachers need to function as educators in digital contexts. It concerns the basic digital skills, knowledge, and attitudes that teachers, teacher educators, and student teachers need to use digital technology in their everyday practice, including software and knowledge on the responsible use of technology, such as privacy and copyright issues.

Subject-didactic digital competence (SDDC) captures how digital technology incorporates and constrains subjects. It includes the basic digital skills, knowledge, and attitudes that teachers, teacher educators, and student teachers need to use digital technology in their subject teaching. This may, for example, include the use of modeling and simulations in science subjects and language labs in foreign-language teaching.

Profession-related digital competence (PrDC) is connected to teachers’, teacher educators’, and student teachers’ profession-related enactment of PDC—how they design lessons, approach (online) assessment and feedback, and communicate with colleagues. Moreover, it extends beyond subject knowledge and includes competence in policy; school communication; management in technology-rich classrooms; relational skills, such as dealing with digital bullying and harassment; and ways an educator approaches their continuous professional development regarding questions about digitalization and digital technology.
Transformative digital competence (TDC) is the component of PDC concerned with teachers', teacher educators', and student teachers' agency in using digital technology to turn unforeseen and demanding classroom situations into positive and rich teaching and learning experiences. We are aware of recent discussions in research regarding TDC's meaning and intention (see, e.g., Brevik et al., 2019, Grov Almôs et al., 2021, Lund & Aagaard, 2020, Nagel et al., 2023).

Next, we briefly describe Swedish TE. Then we provide insight into the method we used, including the specific educational policy on TE analyzed in this paper. Then we present the results and analysis. The paper ends with a discussion, including our main conclusions and suggestions for further research.

4. Contextual background on Swedish TE

According to Åstrand (2017), the question of fragmentation in Swedish TE has been reoccurring and has concerned issues such as to what extent student teachers during their enrollment in TE, on one hand, become sufficiently academically trained and, on the other hand, are sufficiently prepared for their future professions as teachers in K–12 schools (Erixon Arreman, 2008). The latest Swedish TE reform, in 2011, addressed the issue of fragmentation, stressing the importance of TE creating educational incitements for facilitating future teachers' professional identities (Government Bill, 2009/10, 2009). One example here is that the general educational science courses, totaling 1 year of full-time study (60 ECTS), considered central to the teaching profession, became more specialized for each degree through the reform (Lindfors et al., 2021). These courses, together with a 6-month placement (30 ECTS), are mandatory for all student teachers regardless of the length of their teacher program and the type of teaching degree they seek. In Sweden, TE program lengths range from 3 to 5.5 years of full-time study (see also Alvunger & Wahlström, 2018). Due to Government Bill (2009)/10 (p. 89), all Swedish TE programs also consist of an orientation field with one or more areas of emphasis (at least 40 ECTS specific to a subject or subject area) and one area of specialization to deepen and broaden students' previously acquired knowledge (at least 20 ECTS).

5. Method

Building on research indicating challenges connected to the digitalization of Swedish TE and the level of Swedish teacher educators' PDC (see Amhag et al., 2019, Hanell, 2018), we conducted a content analysis (Krippendorf, 2018) of policy documents governing Swedish TE. In this qualitative study, in an interpretative paradigm for making meaning of Swedish TE policy (Bryman, 2012), the process of selecting which policy to include in the study was carried out in the following way. Of 28 TE institutions in Sweden, we chose to include the 20 that offer TE programs in which students can earn the degree of Master of Arts in Primary Education for School Years 4–6 in the sampling frame. We took the decision that analyzing all policy documents for the six main TE programs in Sweden was too large a scope and, to some extent, too diverse as an empirical sample; therefore, and as a direct consequence, we decided to collect policies from all 20 TE institutions offering this specific TE program. The selected TE institutions were spread all over Sweden. Overall, the data comprised the following:

- national guidelines and curriculum regulations for TE in Sweden (e.g., the Swedish Higher Education Ordinance; N = 1);
- program syllabi at the selected TE institutions (N = 20); and
- course plans (for all 240 ECTS, 4-year full-time studies; N = 450), including
  - educational science courses: 60 credits (N = 116),
  - subject courses (Swedish, English, and mathematics): 90 credits (N = 136),
  - subject courses by choice (e.g., social subjects, natural sciences subjects, and practical or artistic subjects): 30 credits (N = 87), and
  - practicum placement courses: 30 credits (N = 43),
  - student thesis course(s): 30 credits (N = 68)
5.1. Data analysis

The first analysis of the empirical data for this paper—the TE policy documents—was conducted using a content analysis. This analysis was inspired by the eight steps Zhang and Wildemuth (2017) recommended. More precisely, we used the following steps (numbered here as in the original source): (1) prepare the data, (2) define the unit of analysis, (3) develop a coding scheme, (4) code all text, (6) assess the coding consistency, (7) draw conclusions from the coded data, and (8) report the methods and findings. Data were analyzed using NVivo12 (Release 1.5.1) and the “Text Search Query” function. In the analysis, we used several Swedish words and concepts to search for words, phrases, and passages in each policy highlighting aspects of PDC and/ or digital technology in teaching, learning, assessment, and classroom management. In NVivo12, we used the “Find: With Stemmed Words” function. We used the following words and concepts translated into English in the search profile: “AI,” “artificial,” “artificial intelligence,” “AR,” “artificial reality,” “augmented reality,” “communication,” “competence,” “computational thinking,” “computer,” “copyright,” “device,” “digital,” “digitalization,” “digitalized,” “digitization,” “digitize,” “educational technology,” “ICT,” “information,” “internet,” “IT,” “language labs,” “laptop,” “literacy,” “media,” “modeling,” “online,” “professional,” “programming,” “technology,” “tablet,” “tool,” “simulation,” “social,” “source criticism,” “virtual reality,” “VR,” “visualization,” and “web.”

We closely read each policy document highlighted in the NVivo12 search to determine whether the search hit signified a text passage relevant to PDC. Then we reanalyzed the outcome of this first round of analysis using the framework on teachers’ and teacher educators’ PDC, building on the works by Gudmundsdottir and Hatlevik (2018) and Gudmundsdottir and Hatlevik (2020) described above. To acknowledge intercoder reliability, in front of the same screen, we conducted both rounds of analysis to establish an as negotiated and shared interpretation of the data as possible (Bryman, 2012).

In the next section, we reveal the findings of the analyses. This is followed by the discussion and conclusions in which the findings are related, for example, to teacher educators’ roles as second-order teachers, specifically the prerequisites in TE policy for the fulfillment of their dual didactic task regarding the use of digital technology to ensure student teachers graduate with a sufficient level of PDC.

6. Findings

A pattern was found in the first round of the analysis of the policy documents steering the TE programs offering the degree of Master of Arts in Primary Education for School Years 4–6. That is, the more connected to the actual TE teaching and learning practices and activities a policy document was, the more often the policy seemed to contain content concerning PDC. For example, in the Swedish Higher Education Ordinance text, aspects of PDC appears in only one formulation. Because TE institutions in Sweden seem to have developed their program syllabi in line with the national policy on TE, the identical formulation was also found in all of the 20 program syllabi analyzed. Only three of them had minor additional text concerning PDC. Of the 450 course plans, 155 included content (text passages or formulations) that were relevant to PDC, which was most often present in the plans for subject courses by choice. Table 1 summarizes the quantitative findings from the content analyses, followed by the findings from the qualitative second round of analyses using the combined definition of PDC described above (Gudmundsdottir & Hatlevik, 2018, Gudmundsdottir & Hatlevik, 2020). The examples of formulations in Table 1 are translated from Swedish into English.

6.1. A second round of analysis: searching for dimension-based signs of PDC

As Table 1 shows, the Swedish Higher Education Ordinance contains only one formulation—one expected learning outcome—concerned with aspects of PDC: “Show the skill of using digital tools in educational practice in a safe and critical way, and be able to take into consideration which roles different media and digital environments can play in this practice.” This formulation can be read as part of GDC; therefore, TE institutions can include dimensions of at least SDDC and PrDC in the
Table 1. Signs of professional digital competence (PDC) in Swedish TE policy

<table>
<thead>
<tr>
<th>Category of policy document</th>
<th>The number of documents in each category of policy showing signs of PDC</th>
<th>Examples of formulations within each category of policy showing signs of PDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Swedish Higher Education Ordinance</td>
<td>1 out of 1</td>
<td>“Show the skill of using digital tools in educational practice in a safe and critical way, and be able to take into consideration which roles different media and digital environments can play in this practice.”</td>
</tr>
<tr>
<td>Program syllabi at the selected TE institutions</td>
<td>20 out of 20</td>
<td>“Show the skill of using digital tools in educational practice in a safe and critical way, and be able to take into consideration which roles different media and digital environments can play in this practice.” “Show didactic skills in using information technology to develop teaching and learning in School Years 4–6.”</td>
</tr>
<tr>
<td>Educational science courses (60 credits)</td>
<td>15 out of 116</td>
<td>“Know how to search for and value different digital tools to be used in learning environments together with children.”</td>
</tr>
<tr>
<td>Subject courses (e.g., English, Mathematics &amp; Swedish) (90 credits)</td>
<td>50 out of 136 English = 12 Mathematics = 21 Swedish = 17</td>
<td>English: “From a critical perspective, know how to use digital tools, both for one’s own learning and in teaching the subject of English.” Mathematics: “Value and problematize the use of digital tools and virtual learning environments for enhancing teaching and pupils’ learning in mathematics and programming.” Swedish: “The course includes communicative forms of expression and ICT to facilitate children’s and youths’ development of their languages.”</td>
</tr>
<tr>
<td>Subject courses by choice (e.g., Arts, Sports, Music, Natural Science, Social Science) (30 credits)</td>
<td>54 out of 87 Arts = 13 Sports = 5 Music = 8 Natural Science = 16 Social Science = 12</td>
<td>Art: “Be able to reflect upon the meaning of art and media in children’s and youth’s visual cultures, as well as to integrate digital resources as pedagogical tools.” Sports: “Demonstrate knowledge about how digital tools can be used to develop visual learning within sports.” Music: “Be able to use both analogue and digital equipment in music creation, as well as reflect upon its role as a pedagogical tool.” Natural Science: “Be able to identify, analyze, and design digital learning resources within natural science subjects and technic from a teaching and learning perspective.” Social Science: “Be able to describe and provide examples of how digital tools can be used in a didactic way within teaching in the social sciences.”</td>
</tr>
<tr>
<td>Practicum placement courses (30 credits)</td>
<td>13 out of 43</td>
<td>“Demonstrate knowledge of digital tools in educational practices.” “Demonstrate awareness of digital tools from a subject didactic perspective.”</td>
</tr>
<tr>
<td>Student thesis course(s) (30 credits)</td>
<td>0 out of 68</td>
<td>-</td>
</tr>
</tbody>
</table>
program syllabus or local subject course plans. The 20 program syllabi analyzed contained this specific expected learning outcome from the Swedish Higher Education Ordinance. Only three program syllabi included additional text related to PDC. All three concerned SDDC (e.g., “Show didactic skills in using information technology to develop teaching and learning in School Years 4–6”), and one of the three also featured signs of GDC (e.g., “Demonstrate knowledge of the role of digitalization in education and schooling”).

Next, the findings from the analysis of the course plans are presented. We searched for signs of PDC in the following order: (a) educational science courses, (b) subject courses (including English, mathematics, and Swedish), (c) subject courses by choice (art, sports, music, natural sciences, and social sciences), (d) practicum placement courses, and (e) student thesis course(s). Because the number of course plans analyzed was relatively high (N = 450), the findings were concentrated on how signs of the four dimensions of PDC occurred in the categories of the course plans. Text passages or formulations in the course plans are used as examples of how one or more of these dimensions are articulated in policy.

6.2. Educational science courses
This category contained few course plans with formulations signifying dimensions of PDC (15 out of 116). Most of these contained just one formulation, and a few of them contained two. The dimensions of PDC identified in these course plans were mainly GDC and PrDC. Regarding GDC, formulations such as “Know how to search for and value different digital tools to be used in learning environments with children,” “Be able to use basic digital tools for searching information,” “This course concerns digital tools, source criticism, and how to search for information,” and “Be able to give a digital presentation” are present. Among formulations relevant to PrDC, one can find, for example, “Be able to use digital tools for one’s own learning.” “Have the skill to use basic digital tools for collaboration,” “Know about how digital tools can be used in the work [of a teacher] to meet the needs of all children in School Years 4–6,” and “The course also touches upon ICT and its relevance for pupils’ social relations.” None of the 15 policy documents contained signs of TDC.

Acknowledging the educational sciences courses concerning the teaching profession more generally, it is still worth noting that no signs were found describing aspects of SDDC.

6.3. Subject courses (Including English, Mathematics, and Swedish)
Overall, 50 of 136 course plans for the subjects of English, mathematics, and Swedish were interpreted as showing signs of PDC in the framework.

6.3.1. English
In the course plans for English (12 of 50), signs of GDC and SDDC were most frequent. Signs of PrDC were present in just one of the 12 course plans, with a focus on the students’ professional development (e.g., “From a critical point of view, use digital tools for one’s own learning”). No signs of TPD were found in GPD, several formulations concerned basic digital skills and the knowledge that student teachers need to utilize digital technology in their everyday practice in TE and in their future profession as teachers, such as “One general goal is that the student broadens his/her knowledge about ICT,” “Throughout the course, demonstrate the ability to use ICT for educational purposes,” and “IT tools are used for taking part of recorded lecturers, to do oral presentations, and for text-based discussions.” Most signs were found within SDDC. They often pointed out the importance of using digital technology when teaching English, but they also concerned pupils’ learning and the teacher’s ability to evaluate teaching material in digital media critically, such as “In a critical way, use digital tools when teaching English,” “A general goal is that the student develops knowledge about digital tools as a resource when teaching English as well as in pupils’ learning,” “Specifically acknowledge the opportunities in using ICT in language teaching to develop students’ receptive, productive, and interactive skills in relation to the curriculum regulating the subject of English for School Years 4–6,” and “Critically review and evaluate teaching material in English as well as content and information from different [digital] media.” Formulations also concerned how to design teaching in the subject of English: “From
a didactic perspective, design and carry out teaching supported by digital and esthetical learning processes.” They also showed the importance of theoretical underpinnings: “Demonstrate a solid knowledge of language didactic theories, methods, and digital tools (ICT) with a focus on teaching English in School Years 4–6, and know how to put it into action in the classroom context.”

6.3.2. Mathematics

The signs of PDC in mathematics course plans were slightly more frequent (21 out of 50), but at the same time, they practically followed the pattern identified in the course plans for English. Most of the shorter formulations included either GDC or SDDC. Here, SDDC was the most common dimension, probably because programming is mandatory content now in the Swedish K–12 school policy for mathematics. Once again, no signs of TDC could be found. However, a few course plans were interpreted as containing signs of PrDC.

Most of the formulations identified as featuring signs of GDC concerned basic digital skills to be used in everyday school practice as well as aspects of GDC that people need to become teachers, such as “With a certain degree of support, be able to use digital tools in an educational practice,” “Know basic programming,” and “Use digital learning resources in school.” SDDC formulations targeted aspects of digital technology use in teaching mathematics as well as digital simulations, such as “In the course, programming and laboratory in geometrics are done in a digital environment, where both subject-theoretical and subject-didactic consequences that stem from the use of digital technology in pedagogical practice are discussed,” “Through digitally enhanced math teaching, the students are given opportunities to work with digital tools and virtual learning environments, as well as the basics of programming,” and “Demonstrate knowledge of when, how, and why ICT as well as practical and esthetical learning processes can be used in given teaching situations in mathematics.” Few course plans contained formulations interpreted as featuring signs of PrDC, such as “Demonstrate the ability to plan a sub-theme in mathematics, taking several shapes of work into consideration, and moreover, show how digital tools can be used as a resource in teaching” and “Be able to apply programming in mathematics in accordance with policy documents for the school.”

6.3.3. Swedish

The last of the course plans in this category concerned Swedish. Of the 50 course plans, 17 contained signs of one or more dimensions of PDC. Once again, signs of GDC and SDDC were most common in the course plans; no signs of TDC were present. Regarding GDC for Swedish, several formulations targeted basic skills and aspects of source criticism, such as “Be able to make conscious decisions, and apply and discuss a source critical approach when searching for information on the internet” and “Demonstrate the ability to describe, discuss, and apply different methods for the text analysis of written and multimodal texts, as well as texts in digital media.” Formulations signifying SDDC often concerned didactic issues and various esthetical expressions, such as “Be able to reflect on digital resources and their didactic potential in a critical way when teaching reading and writing” and “Be able to exemplify how digital tools and esthetical ways of expression can be used for stimulating and developing pupils’ reading and writing.” Concerning PrDC, most formulations concerned the use of digital technology as a component in students’ professional development, such as “In dialogue with others, analyze and discuss fiction, digital, and multimodal texts, as well as other texts for children” and “Be able to be part of net-based relations and make use of digital media for collaboration and learning.”

6.4. Subject courses by choice (including Arts, Sports, Music, Natural sciences, and Social Sciences)

Overall, 54 of 87 course plans for subject courses by choice were interpreted as containing signs of PDC. This occurred most often in course plans for natural sciences, followed by course plans for the arts and social sciences. However, below, we present our findings for all five subjects.
6.4.1. Arts
Regarding the arts, 13 of the 54 course plans showed signs of PDC, with signs of either GDC or SDDC being the most common. Signs of PrDC were limited whereas signs of TDC were nonexistent. Regarding GDC, these formulations often included digital technology and various art forms, such as “Know how to create pictures with digital and handicraft techniques and tools,” “Be able to work in practice with digital methods and techniques, movies, and photography,” and “Demonstrate the ability to integrate digital techniques as a pedagogical tool.” Regarding SDDC, formulations concerned didactic aspects of the arts together with student teachers’ ability to reflect on digitalized school practices, such as “From a subject didactic point of view, discuss and problematize the opportunities of digital technology to enhance and develop pupils’ visual competence” and “Be able to reflect on visual expressions and on the role of digital media in children’s development and learning.” Formulations interpreted as signifying PrDC concerned policy and aspects of student’s professional development, such as “Be able to convert knowledge in the arts, which is also present in the steering documents for this subject, into a digital learning resource for pupils in elementary school” and “The work during the course is collected in an individual digital process portfolio. The portfolio collects both subject-specific knowledge of material, techniques, and art communication, as well as didactic knowledge and reflections concerned with progression and learning.”

6.4.2. Sports
Only five of 54 course plans for sports showed signs of PDC. The signs were equally distributed between GDC and SDDC. Only a couple of them were interpreted as PrDC. No signs of TDC were found. One example of GDC is “Show deeper knowledge of how to use digital tools to develop visual learning in sports.” A typical formulation signifying SDDC was “to choose and use appropriate ICT tools for the teaching, documentation, and analysis of pupils’ work and performance.” One of the two formulations signifying PrDC was “the ability to, on an individual basis and supported by digital tools, lead, carry out, and evaluate practical teaching activities.”

6.4.3. Music
Of the 54 course plans in this category showing signs of PDC, eight concerned music. The findings in the course plans for music mirrored the findings regarding sports to a large extent, including no signs of TDC. Formulations signifying GDC often concerned the idea that students should demonstrate the ability to use digital technology in a basic way in music, including “to use digital media as tools for sound and music creation” and “Digital tools are used in music creation, in recording, and in producing.” Regarding SDDC, signs often signified that the basic skills that students develop should be visual in didactic choices and teaching activities, such as “Be able to integrate different artistic expressions into music teaching supported by digital tools” and “Be able to apply digital tools as support in music didactic work.” Finally, signs of PrDC in the course plans for music can be seen, for example, in terms of “being able to exemplify and discuss music creation and digital media based in a scientific approach, the policy document for the K–12 schools, and didactic standpoints.”

6.4.4. Natural sciences
Among the course plans for subject courses by choice containing formulations signifying PDC, the course plans for natural sciences were interpreted as containing the most (16). It is noteworthy that among the course plans for subject courses, a sister subject to natural sciences, mathematics, showed the most signs in that category. However, regarding natural sciences, the signs were distributed quite evenly between GDC and SDDC. Two signs of PrDC and none regarding TDC were present. The formulations regarding GDC in relation to the content in the courses and the expected learning outcomes were mainly concerned with basic digital skills and programming. Examples of formulations were “Be aware of digital tools for learning in natural sciences and technology” and “A specific focus is put on computational thinking, which can be described as problem-solving using computers. Thereafter, basic programming is introduced and with a focus on its use in school.” Formulations signifying SDDC ranged from more general descriptions to specific methods.
in teaching, including “Give an account of how different ways of working, esthetical forms of expression, and digital resources can be used in teaching in natural sciences and technology,” “Know how to visualize chemical models, chemical phenomena, and processes supported by ICT,” and “In the course, different kinds of digital documentation are discussed; know how these provide opportunities for the learning and communication of technical knowledge, for example, using digital storytelling.” Regarding PrDC, the following formulation mirrors a sign of the dimension of PDC: “Be able to identify, analyze, and design digital learning resources within the natural sciences and technology from a teaching and learning perspective.”

6.4.5. Social sciences
The course plan analysis regarding the last subject—social sciences—in the category of subject courses by choice revealed that 12 plans showed signs of PDC and none had signs of TDC. One plan involved the following: “In the course, some specific thematic issues with relevance for teaching in social sciences are brought up—more precisely, digital competence, esthetical learning processes, assessment, pedagogical documentation, and teaching new pupils in Sweden.” The other plan included the following: “A specific theme concerns digital competence in School Years 4–6.” Course plan formulations concerning GDC were relatively short and succinct. In addition, formulations concerned the question of source criticism, such as “The course includes media, information, digitalization, and source criticism” and “The students shall try to critically evaluate digital methods.” Formulations signifying SDDC were relatively broad in scope, such as “Be able to describe and give examples of how digital tools can be used in a didactic way in teaching social sciences” and “Be able to both give an account of principles for source criticism and demonstrate knowledge of how source criticism can be used in teaching.” Among the rather few signs of PrDC in the course plans for social sciences, focus is placed on the student’s professional development using digital technology: “The students are expected to take initiative to organize their own digital work meetings.”

6.4.6. Practicum placement courses
In this category, the analysis showed that 13 of the 43 course plans contained signs of PDC. In addition to featuring no signs of TDC, formulations signifying PDC were evenly distributed among the other three dimensions. Formulations signifying GDC were rather broad in nature, such as “Give an account of how information technology can be used in pedagogical practice” and “Give an oral presentation using digital tools.” Formulations concerning SDDC were rather general as well, such as “Show awareness of digital tools from a subject didactic perspective” and “By using subject didactic knowledge, integrate practical-esthetical forms of expression and digital resources into teaching.” Regarding PrDC, the formulations concerned either aspects of professional development (“Use a digital practicum placement portfolio”) or the design of teaching (“Demonstrate the ability to apply didactic and language didactic theories when planning, carrying out, and evaluating a series of lessons with a focus on pupils’ development of literacy”).

6.4.7. Student thesis course(s)
No signs of PDC were found in any of the course plans for the student thesis course(s).

6.5. The findings in sum
Based on the two-step analysis conducted to locate signs of PDC in the policy documents steering 20 Swedish TE programs offering the degree of Master of Arts in Primary Education for School Years 4–6, this competence was relatively seldom addressed. Moreover, signs of PDC that are coming through in our interpretational work often concern the dimensions of GDC and SDDC. That is, text passages and formulations concern the basic digital skills, knowledge, and attitudes that student teachers need to use digital technology in their future everyday school practice, including in their subject teaching. Notably, signs of PrDC were few and signs of TDC were nonexistent. Next, we discuss these findings in the light of previous research, and finally, we provide conclusions, limitations, and possible further research directions.
7. Discussion
As aforementioned, young people around the world are growing up in a digitally infused society (Livingstone et al., 2023). For that reason, educators around the globe need to take on the collective responsibility to assure that the next generation of citizens become capable of using technology in their everyday activities and future working lives (Gisbert Cervera & Caena, 2022). However, given a somewhat insecure world with ongoing conflicts and wars in combination with, for example, political campaigns using the internet to disseminate disinformation, the most important aspect of young people developing a multidimensional and critically orientated digital competence (Örtgren, 2023) is perhaps questions of democracy and digital citizenship (Choi, 2016, Choi & Cristol, 2021, Vuorikari et al., 2022). Reports from a large body of research point in the same direction. First, K–12 school teachers need sufficient PDC and knowledge to help pupils develop their digital competence (see, e.g., Nagel, 2021; Olofsson & Lindberg, 2021). Second, such know-how requires teacher educators to arrange teaching and learning environments that enable student teachers to develop their PDC (see, e.g., Andreasen et al., 2022, Brianza et al., 2023, Jimarkon et al., 2021, Skantz-Åberg et al., 2022).

Young people’s development of digital competence is not exclusively important for a specific part of the world or even a specific country; rather, it is a global concern. However, as Starkey and Yates (2022) and García-Vandewalle Garcia et al. (2023) argued, despite well-developed international guidelines and frameworks regarding PDC and digital competence (e.g., the European Union’s DigCompEdu, the International Society for Technology in Education (ISTE) standards, and the Norwegian Professional Digital Competence Framework for Teachers), educators need context sensitivity. This means that such guidelines and frameworks can be adapted considering the national educational context. This also means that findings reported in this paper are important beyond Sweden’s borders, but they probably need to be reflected in the light of each country’s national or local TE policy and practices concerning student teachers’ development of PDC.

7.1. Exploring the prerequisites in Swedish TE policy for teacher educators to fulfill their dual didactic task
Acknowledging the importance of educational context sensitivity as described, this study’s design was inspired by Instefjord and Munthe (2016, 2017), who described the extent to which the use of digital technologies and dimensions of digital competence were integrated into the policy documents steering TE in Norway. In 2006, the ability to use digital tools was already considered one of the five basic skills that Norwegian pupils had to develop during their time in primary and secondary school and to master afterward. Formulations in policy put the question of digital competence high on the agenda for TE in Norway. Interestingly, Instefjord and Munthe (2016, 2017) concluded that neither the use of digital technology nor digital competence, to a larger extent, was stressed in Norwegian TE policy documents. Given the Norwegian political and educational ambitions over time regarding these issues, Instefjord and Munthe’s (2016, 2017) results were rather surprising. The question that immediately came to our mind was, what is the situation with Swedish TE policy? More precisely, we became interested in investigating the prerequisites in Swedish TE policy for teacher educators to fulfill their dual didactic task of arranging digital teaching and learning practices (Uerz et al., 2018). Such prerequisites for teacher educators to perform their dual didactic task is necessary for developing student teachers’ PDC to such a level that they are capable of creating educational incentives for K–12 pupils to develop adequate digital competence in line with recent Swedish school system policies (e.g., the National Digitalization Strategy for the Swedish School System and the National Plan for Action for the Digitalization of the Swedish School).

Previous studies stressed that TE is an educational institution in which the use of digital technology and PDC is acknowledged as a very important competence in student teachers’ future work lives (Amhag et al., 2019; Edstrand & Sjöberg, 2023; Erstad et al., 2021; Lindfors et al., 2021; McGarr & Ó Gallachóir, 2020; Siddiq et al., 2023; Voithofer et al., 2019). However, research in this field also presented findings in accordance with ours. Put differently, too seldom, policies regarding
TE focus on the integration of digital technologies into teaching and learning activities promoting the development of student teachers’ PDC (Foulgeri et al., 2017). In addition, the formulations seem basic content-wise and are not properly implemented and taught in practice (Arstorp, 2015, Blamire et al., 2017, McGarr & McDonagh, 2019). With this brief background, we discuss some of the main findings from the content analyses conducted on the policy documents steering the 20 Swedish TE institutions offering the the degree of Master of Arts in Primary Education for School Years 4–6.

As a lens for analyses, we used Gudmundsdottir and Hatlevik’s (2018, 2020) conceptualization of PDC (GDC, SDDC, PrDC, and TDC). Four dimensions are combined and portray the complexity of what the digitally competent teacher should be, know, and be able to do in today’s digitalized everyday K–12 school practice (cf. Lund et al., 2014). An analysis of the 471 collected TE policy documents showed that 176 documents contained text passages or formulations featuring signs of PDC. The first observation in this analysis was that the integration of digital technologies and learning activities promoting the development of PDC was stressed only once in the highest policy document in the hierarchy of documents steering Swedish TE based on the Swedish Higher Education Ordinance. Moreover, all 20 TE program syllabi contained this exact same formulation whereas only program syllabi from three programs had additional formulations featuring signs of PDC. Interestingly, the formulation in the Swedish Higher Education Ordinance falls within the GDC dimension of PDC, meaning that the expectations of how PDC shall be integrated into course policy and practice appear to focus on student teachers’ basic digital competence. This potentially sends the signal, although probably not always explicitly, that PDC is not among the competencies that most professional teachers need in today’s K–12 school, a signal that is also sent to teacher educators in the 20 programs responsible for writing up and implementing course plans.

The second observation was that even if the signs of PDC across the analyzed policy documents overall were limited, some interesting findings concerned the presence of PDC’s various dimensions in the TE course plans. For instance, about one third of the course plans for the subject courses (50 of 136) and about half of the course plans for the subject courses by choice (54 of 87) showed signs of PDC. In both categories of course plans, signs of GDC and SDDC occurred more often, which could indicate an acknowledgement of the importance of providing student teachers with opportunities to learn how to use digital technology in subject teaching. In these two categories of course plans, digital didactical competence appeared to receive slightly more attention in plans concerning mathematics and natural sciences. It can be noted, though, that these signs of GDC and SDDC seemed relatively general in their formulations or involved aspects of programming. Some knowledge was rather heavily pushed forward in the Swedish school system—for example, in the revised curriculum from 2018. Signs of PrDC were sporadic, and signs of TDC were nonexistent in these two categories of course plans. A finding indicated that student teachers in the investigated type of TE program were not provided with sufficient opportunities to develop their subject teaching in relation to, for example, subject school policy, leadership and management in technology-rich classrooms, or how to use digital technology to turn challenging classroom situations into teachable events (Brevik et al., 2019, Lund & Aagaard, 2020). A related observation was that courses in Swedish TE with a certain responsibility, in theory and practice, for student teachers’ professional development in their role as teachers in educational science courses (15 of 116) and practicum placement courses (13 of 43) showed few signs of PDC overall. One might have expected the dimensions of PrDC and TDC to be much more visible in these course plans. High levels of PrDC and TDC could help future teachers deal professionally with challenging relational issues, such as digital bullying and harassment in school. Moreover, a more distinct focus on PDC in practicum placement courses provided student teachers with the opportunity to “put PDC into practice” and to collaborate with their local school supervisors to discuss “the reality” in schools regarding the digitalization of teaching and learning as well as the question of “adequate digital competence.”
Building on the two observations above, our third and final observation was the overall limited prerequisites associated with TE policy for teacher educators to fulfill their dual didactic tasks when working in 20 Swedish TE programs offering the degree of Master of Arts in Primary Education for School Years 4–6.

The analysis revealed that PDC, as indicated in the Swedish Higher Education Ordinance and in individual subject course plans, is a competence that has not been sufficiently addressed (cf. Foulgeri et al., 2017, Mohamed et al., 2017). In addition, when addressed most often, the formulations in policy concern basic knowledge and skills in the dimensions of GDP and SDDC. There is a clear lack of PrDC and TDC, two dimensions that capture the digital attitudes, skills, and knowledge that teachers need to complete their work beyond their specific subject. Moreover, and with the disclaimer that we have not collected any empirical data from these TE programs, the potential challenges connected with student teachers’ development of PDC might be even greater due to previous research reporting a low level of alignment between policy and TE practice. Therefore, these foreseen challenges are mirrored in international research, reporting that teacher educators generally have low levels of PDC (Uerz et al., 2018). Put differently, they are not yet knowledgeable enough about how to use digital technology in teaching and learning activities with their student teachers (Pedro et al., 2019, Tondeur et al., 2016).

8. Conclusions, limitations, and directions of future research
In correspondence with previous research, the findings of this study showed that PDC does not have a prominent place in policy for this type of TE program in Sweden. An old truth in educational research is that the content and expected learning outcomes formulated in policy steer what is taught and examined to a high degree. This means that if teaching and learning activities in the 20 TE programs are designed in close alignment with formulations in the policy analyzed, the student teachers will most likely leave TE with limited levels of PDC to use in their future working lives. However, it is important not to turn this current situation in Swedish TE into a blame game. If TE policy does not clearly prescribe the necessity of student teachers’ development of a four-dimensional PDC, teacher educators will focus on what in fact is prescribed in policy. This means that teacher educators’ dual didactic task instead will be performed with the goal of fulfilling other expected learning outcomes in policy rather than teaching student teachers how to teach for their future pupils to develop adequate digital competence. In short, the prerequisites provided in policy for teacher educators to perform this specific dual didactic task are not sufficient in a Swedish TE context.

In the long run, this will be a serious challenge for not only the Swedish school system but also Sweden as a highly digitalized knowledge nation. The findings revealed the urgent need to revise the current policy steering TE because this will help ensure that PDC is properly addressed throughout the student teachers’ time in TE. It will also help systematize continuous professional development in PDC for teacher educators. The main lesson learned is that TE and teacher educators in Sweden need to develop an awareness of PDC and be prepared to integrate all four dimensions of this competence into policy, theory, and practice. The same is true for TE and teacher educators in many other European countries.

A limitation of this study is that it focused on content and intentions in Swedish TE policy and did not capture how teacher educators in actual practice develop student teachers’ PDC. The study included only the policy documents that TE programs legally need to follow. Put differently, documents, such as study guides, in the programs might provide rich opportunities for student teachers to develop all four dimensions of their PDC. Another study limitation is that we analyzed one of the six main types of TE programs in Sweden. PDC and its complexity may be handled in greater depth in these TE programs. Given these described limitations, researchers could focus on how teacher educators work in practice with the concept of PDC. Researchers could focus on teacher educators’ PDC for fulfilling their dual didactic task of developing student teachers’ PDC. Researchers could also focus on how student teachers understand and enact their PDC in various subjects and in parts of their teacher professions more generally. A final suggestion for further
research is to investigate opportunities for student teachers during practice placement to design teaching activities in which PDC plays a central role. In addition, this will make it possible to investigate to what extent teachers, in the role of the student teachers’ supervisors during practice placement, in their turn can perform this specific dual didactic task concerning PDC.

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