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"And then I check to see if it looks legit" – digital critical competence in teacher education

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This study investigates pre-service teachers' understanding and use of their own digital critical competence. In the Norwegian teacher training programmes, pre-service teachers at all levels are required to develop critical reflection skills and learn basic digital skills. They have to be able to communicate digitally and at the same time be able to reflect on how developments in technology entail a growing need for critical assessment of digital media. Through a qualitative approach, we interviewed 17 social studies pre-service teachers at UiT The Arctic University of Norway and asked how they understand and use digital critical competence. Our study shows that the students' understanding of digital critical competence as a concept in the early stage of their education is mainly linked to source criticism and can largely be classified as a procedural understanding. A procedural approach means acting without any consideration of the underlying intentions; it requires little thought, and cognitive operations are ignored. More experienced pre-service teachers can link digital critical competence more clearly to the teaching profession and the school context and can reflect on didactic perspectives. They have a more norm-critical approach and question how information and knowledge are established. We find that they have developed a more critical and reflexive approach. The implication for teacher education is that digital critical competence should have a space in all subjects, not just social studies. This will help improve the quality of education and equip the pre-service teachers for everyday life as critical and reflexive teachers.

KEYWORDS

critical thinking, teacher education, digital competence, pre-service student teacher, critical-reflexive

Introduction

Social media are vital to every part of our life, and the Internet is a source of quick and easy access to information. Everyone can share and spread their thoughts on political, cultural, economic, historical, and social matters from different perspectives and in whatever "truth" they believe in. Castellvi et al. (2020, p. 1) argue that the digital age has changed how we interact through the media, how we learn, how we communicate, and how we access information. Grut (2021, p. 9) claims that the sheer volume of digital information makes it very challenging to ascertain whether the content is reliable or not. Castellvi et al. (2020, p. 1) write that "the information it offers often reproduces hegemonic narratives and can be lacking in rigor, or even biased or false." Several studies, according to Breakstone et al. (2022, p. 963–964), shows that university students struggle to evaluate information that are online. This also aligns with a previous study of McGrew et al. (2018, p. 165) where they find that students from middle school,

high school and college had difficulties evaluating sources on internet. Critical thinking is therefore vital for assessing stories and information found online and is an important key competence for both today and the future (Hulin, 2018, p. 86). Critical thinking is an important factor in digital competence (Nascimbeni and Vosloo, 2019, p. 11). Digital competence can broadly be defined as “the confident, critical and creative use of ICT to achieve goals related to work, employability, learning, leisure, inclusion and/or participation in society” [defined by Kampylis et al. (2015, p. 39); Mattar et al. (2022, p. 12)]. To develop digital competences, organisations such as UNESCO, the European Commission and International Telecommunication Union, commercial actors such as Microsoft and Google (Nascimbeni and Vosloo, 2019, p. 5), educationists, and schools all over the world are now participating in educating citizens to become digitally critically competent.

In the Norwegian education context, digital competence is of great importance. In a white paper concerning the school of the future (Official Norwegian Reports NOU, 2015: 8, p. 26), it is stated that the use of technology is a significant part of our lives and that digital competence is a prerequisite to participating in education and society. As an answer to the future demands and challenges of a digital society, the government of Norway has adopted a national curriculum that focuses on 21st-century skills (Bakken and Andersson-Bakken, 2021, p. 729). These skills, among others, include critical thinking, technology skills, and digital literacy and are incorporated in our understanding and use of the concept of digital competence.

The latest national curriculum reform called “Fagfornyelsen”¹ [literally: subject renewal] included a strengthening of critical thinking as a topic and highlighted critical thinking as a fundamental aspect of the underlying core values for education (Norwegian Directorate for Education and Training, 2017, p. 5–6).² In the curriculum of pre-service social studies teachers, it is emphasised that the subject must help educate pupils to become “critically thinking citizens” who possess digital competence (Norwegian Directorate for Education and Training, 2020, pp. 5, 6 and 12). In other words, they must become digitally critically competent. In a study of two cohorts of pre-service teachers’ professional digital competence, it was found that after the teacher education reform of 2017 the students had improved their professional digital competence (Andresen et al., 2022). Despite this study and these explicit and clearly defined requirements for digital critical competence, research in the national context (Røkenes and Krumsvik, 2016; Instefjord and Munthe, 2017; Instefjord, 2018; Langset et al., 2018; Mikkelsen and Rist, 2018; Gudmundsdottir and Hatlevik, 2020) shows that there is still a considerable mismatch

between the requirements imposed in teacher education programmes and the digital competencies teacher graduates have when they enter the profession as schoolteachers. In addition, recent research (Weyergang and Frønes, 2020) has revealed that there is broad variation in Norwegian primary school pupils’ ability for critical thinking. Furthermore, Ferguson and Kränge (2020) found that teachers have not received sufficient training in how to develop pupils’ critical thinking. This may have consequences for how the teacher education contributes to the development of the pre-service teachers’ critical thinking and their digital competence. Thus, there is a need for more studies on critical digital competence in education and in teacher education in particular.

At UiT The Arctic University of Norway (hereinafter UiT), critical thinking and digital competence are explicit goals in pre-service social studies education. It is particularly central in one of the master’s degrees courses, namely social studies didactics and critical thinking (Programme Description, 2022). However, we do not have much information about the level of digital critical competence among social studies pre-service teachers, neither when they enter the programme nor when they finalize their education. By conducting interviews of 17 pre-service social study teachers in the second and fourth year of their education programme, the current study investigated the following research question: how do social studies pre-service teachers understand and use their own digital critical competence?

To answer this research question, we formulated some sub-questions for elaboration. We asked the pre-service teachers how they understand the concept of critical thinking and how they define the concept of digital critical competence. In addition, we asked the pre-service teachers to describe the process they use when they assess digital sources in a critical way. Exploring this research question might indicate if the pre-service teacher’s perception of their own digital critical competence is in line with their practice.

We will start by exploring the theoretical framework of the concept of digital competence in an educational context. Thereafter we will present the methodological approach of the study. We chose to combine the results and discussions, based on the interviewees’ interpretation of the concepts and the description of practice together with the progression and development of competence. We thereafter summarize our findings and highlight the didactical implications for teacher education programmes in general.

Theoretical framework: critical thinking and digital critical competence

Because critical thinking is a part of digital competence, it is important to elaborate on our understanding and use of the concept critical thinking. There is no single definition of critical thinking, and it can be interpreted in myriad ways. Ryen et al. (2019), for example, define critical thinking as the ability to use rationality in an independent and investigative way to identify the premises that underlie various claims. Ferrer and Wetlesen (2019, p. 11) offer a similar definition, saying that critical thinking is “reflective thinking and an active and evaluative approach to assumptions and accepted truths.” They stress that critical thinking is more than source work and methodology alone. Critical thinking is a creative process whereby a

1 The curriculum upgrade was introduced in the Norwegian school system from 2020 as a process for “developing and introducing new curricula in the National Curriculum for Knowledge Promotion” (Norwegian Directorate for Education and Training, 2020).

2 The Norwegian Directorate for Education and Training has the overarching responsibility for education at the kindergarten, primary, and lower secondary and upper secondary levels. The Directorate’s role is to ensure equitable offerings, administer and interpret legislation, develop curricula and framework plans, be responsible for mapping, examinations, and national tests, obtain and collate knowledge, and contribute to the development of competencies and skills (regjeringa.no).

person reflects on different possibilities and perspectives. Alexander (2014, p. 470) and Ferguson and Krangle (2020, p. 196) argues that critical thinking involves thinking “deeply and flexibly about important matters.” Lim (2015) and Ryen et al. (2019, pp. 3–4) focuses on the fact that critical thinking should not only be a purely technical exercise, but that people ought to be trained in justifying their arguments and that awareness about this process must be raised. Critical thinkers can see connections in addition to being able to apply a diversity of perspectives and, not least, to clarify the importance of the power perspective. The power perspective is an important focus of Røthing (2020, p. 27), who believes that critical thinking involves critical reflection on power relations and structures in society. Critical thinking is necessary in order to make informed choices and is thus a prerequisite for democratic participation. It should therefore be possible to translate critical thinking into action in order to foster active citizens (Ferrer and Wetlesen, 2019). Thus, in our study critical thinking entails more than purely a technical approach.

There are several different concepts that coexist, like digital skills, 21st-century skills, information and computer literacy, and digital competence, but according to Nascimbeni and Vosloo (2019, p. 10) digital literacy can be seen as an umbrella concept, and they propose that digital literacy is the most appropriate concept to use. This is “because it clearly entails skills, uses and outcomes.” Additionally, they believe digital literacy entails a more holistic approach that also includes critical thinking.

However, in our context we find digital competence to be a more appropriate and relevant concept. According to Amdam et al. (2022), the concept of competence in Norway and in the other Nordic countries often has a broader meaning than in English-speaking countries. It includes skills, literacies, and *bildung* (Erstad et al., 2021). Furthermore, the concept of digital competence is normally applied in policy documents and curricula in Norway in addition to its use in research (Røkenes and Krumsvik, 2016; Erstad et al., 2021; Andresen et al., 2022; Krumsvik, 2022). Thus, digital competence “can be broadly defined as the confident, critical, and creative use of ICT to achieve goals related to work, employability, learning, leisure, inclusion and/or participation in society. Digital competence is a transversal key competence which enables the acquisition of other key competencies. It is related to many of the so-called ‘21st Century skills’, which should be acquired by all citizens, to ensure their active participation in society and the economy” (Joint Research Centre et al., 2012; Kelentrić et al., 2017, p. 12). This is in line with how the EU’s DigiComp project defines digital competence. In our understanding and interpretation digital competence entails critical thinking, and we thus use the term digital critical competence.

Furthermore, in our study we find it helpful to apply the concepts of ‘procedural’, ‘critical’, and ‘reflexive’ that Hulin (2018, p. 85) applied in a study to connect critical thinking to a digital context. The aim of Hulin’s study was how to teach students critical thinking by combining a procedural, critical, and reflexive approach. A procedural approach means acting without any consideration of the underlying intentions; it requires little thought, and the cognitive operations are ignored. A critical and reflexive approach, in contrast, entails assessing and understanding the background for the action; for example, by identifying whether power structures have set the premises for how we act. Applying these perspectives to social studies in teacher education, it is obvious that digital critical competence entails more than just a scientific method and more than just a

technical and instrumental understanding. It entails an extended analytical and scientific approach to a phenomenon that is more closely aligned to the descriptions given above. This is largely consistent with Hulin’s (2018) distinction between a procedural approach and a critical and reflexive approach, and this is the framework of our discussion.

Methods

Type of study

The aim of this study was to establish a wider picture on social studies pre-service teachers’ perspectives on digital critical competence. Our research question was how the social studies pre-service teachers understand and use their own digital critical competence.

We chose a qualitative approach to get more knowledge about the context and the pre-service teachers’ overall perception of the topic. To obtain and interpret pre-service teachers’ knowledge and practice, we applied a phenomenological approach, where the pre-service teachers presented their experiences and perspectives. Our research question and sub questions derived originally from a recent quantitative survey on digital competence by Johanson et al. (2022). One finding from this previous study, where we focused on the pre-service teachers’ digital competence with respect to digital interaction and communication when they first entered the programme, was that the pre-service teachers themselves believed that they had adequate skills in terms of finding and assessing digital information. Quantitative surveys may have some limitations with respect to understanding the context in which the questions are asked, and there might be a risk that the pre-service teachers’ voices are not sufficiently reflected in these kinds of surveys (Creswell, 2006). In the present study, we sought a deeper understanding of this context using more qualitative approaches. Our aim was to get more knowledge about how they understand “adequate skills” and how they find and assess digital information.

Context and participants

The context of the study was pre-service teachers in UiT’s 5-year primary and lower secondary teacher education programme. There was a total of 60 pre-service teachers in this programme, and 17 of them participated in the study. All of them had elected social studies as one of various subjects in the programme. The researchers and authors are both professors in social studies, one based at Campus Tromsø and the other at Campus Alta.

We recruited six pre-service teachers from the second year of the primary and lower secondary teacher education programme from both Campus Alta and Campus Tromsø who had participated in the previous year’s survey. The interviews were conducted on Zoom and lasted between 20 and 45 min. We thereafter conducted one focus group interview with a group of 11 pre-service teachers. This was conducted in person and lasted 1 h. This group consisted of fourth-year social studies pre-service teachers in the primary and lower secondary teacher education programme from Campus Tromsø. This interview was conducted using the same interview guide.

Data sources

We used a strategically selected sample of interviewees in the sense that the pre-service teachers all had chosen social studies as part of their teacher education. The reason for this was that we were particularly interested in ascertaining what prior digital competence social studies pre-service teachers have when they embark on their education. This choice means that we cannot generalise the results to apply to all pre-service teachers. We developed an interview guide with a total of seven questions where we asked them about their daily use of digital platforms in general, and if they could identify any challenges in finding relevant information using internet. We also inquired how they understood the concepts *critical thinking* and *digital critical competence*. Further we asked what they had learned earlier about digital critical competence. To get a picture on how they practiced their knowledge, we invited them to describe in concrete detail how they find information online and how they assess the information they find. We also asked them to describe in detail how they considered the information they found; how they for example sorted out not valid information. All the participants were informed about the project both in writing and orally and consented to the use of the data in an anonymised form. Both researchers took part in the interviews, in the processing of the responses, and in the subsequent analysis of the material.

Furthermore, using both individual interviews and a focus group interview may have some limitation to our study. The focus group have the advantages of building on each other's arguments, and when stimulating the interaction between participants we may generate different data and knowledge. We were aware of this and made sure that all the students were involved when answering and discussing the questions. Also focus interviews may give more nuanced answers and show differences in opinions and experiences. In addition, the second year students participated by using zoom (because of the corona-restrictions) which may have played a role in how we read their body language or how well we communicated with the students. This seemed not to be a problem, as the students had used digital communications for quite some time and were familiar to this way of communication. We find that the answers from both groups, even though applying different approaches, contributes to the research question and provides and identifies preservice teachers' perspectives. However, due to this methodological limitation, a follow up study further exploring our research question is desirable.

Analyses

We chose a stepwise deductive-inductive model to process the data material (Tjora, 2018, 2021). In this method, induction and deduction are used alternately in a separate and stepwise process (Tjora, 2018). Consequently, we started out by reading through and interpreting the material – first separately, then together – to get an idea of what kind of key words and concepts characterised the pre-service teachers' responses. In an inductive stepwise process, we then sorted these into categories with codes. Some of the codes we worked with were source criticism, including reliability and credibility, independence, multiple perspectives, a lot of information and time-consuming, interpretation and threat to democracy, digital education, citizenship, and professional relevance. In our second

review and discussion of the codes and different interpretations of these, we found that some of the concepts the students used, could be associated with a more analytic and reflexive understanding.

The use of advanced, in contrast to everyday language, indicated that there is a gap in competence amongst the informants. Two main categories emerged: “basic understanding and experience of digital critical competence” and “advanced understanding and experience of digital critical competence.” In the subsequent process, which comprised a more deductive approach, we linked these categories to theories and concepts that could help explain the phenomenon and to cast light on the context of the information (Hammersley and Atkinson, 1996). In this phase, we analysed the material using theoretical models, primarily Hulin's model on procedural and critical-reflexive approach.

As researchers and social studies teachers, we are interested in this type of competence, and our different backgrounds in history and interdisciplinary social sciences, respectively, mean that we may have different experiences of and different knowledge about critical digital competence. We believe that this has contributed positively to the study in that it has broadened our approach to the topic. Doing a critical examination of our knowledge and different perspectives could increase validity of the study, but we choose here to focus on the students' perspectives.

We do have some ethical concerns regarding the selection and processing of data because we both have professional relations to the pre-service teachers we interviewed. We are teachers in their subjects, and this asymmetrical power relationship may have coloured the data we received. Are they giving the answer they think the teacher wants to hear, or are they saying what they themselves really think? At the beginning of the interviews, we spent some time explaining that this was not something that would be evaluated or have an impact on them in terms of their grades or assessment. It is important to bear this perspective in mind in all phases of a study, and especially when considering the reflexive element of the researcher role (Hammersley and Atkinson, 1996).

How do the pre-service teachers understand and apply the concepts of critical thinking and digital critical competence?

In this first part, we will present the findings from the interviews of how pre-service teachers, in their second year, understand the concept of critical thinking. These perceptions contribute to giving us a picture of how they understand digital critical competence. We thereafter analyse and discuss how the different pre-service teacher groups understand digital critical competence.

Critical thinking – many understandings?

When we asked the pre-service teachers in their second year of study how they understand critical thinking, we note that all the respondents stated that it is important to question what is being told or to question the sources, i.e., what we understand as source criticism. For example, one of them said: “The first thing that comes into my mind is source criticism.” Most of the pre-service teachers claimed

that they check the sources to find who created the information provided, and they want to ascertain whether the person or people who have provided the information can be trusted or not. The pre-service teachers also stated that it is important to understand why something is said or written. For example, one of the interviewees said that critical thinking is about being critical towards the information, why it is being conveyed, and who is conveying it. Another mentioned that it is important to know who you can trust and that the sources must therefore be checked several times. Several of them referred to reliability as a key concept. They also stated that it is important to know there are different voices and opinions:

“It is a matter of questioning what you see and perceive, and how things work. So, in a more general level (...) being able to see things from multiple angles and form an opinion about the information available to you (...).”

Many of the pre-service teachers stressed the importance of being able to see that there are multiple perspectives and the ability to think independently. One of them pointed out that after starting on the degree programme they realized that most books and articles used in the programme were based on something that had previously been written that the content was an interpretation, and that they should again interpret what had been written. The pre-service teachers stated this can be challenging, “What was the real meaning behind the original message?” The more experienced pre-service teachers mentioned source criticism as an important part of critical thinking but found that the concept had a wider meaning. For example, for them critical thinking could include a norm-critical approach.

Discussion: how do the pre-service teachers understand critical thinking?

As described in the introduction and in the theory section, in this article we regard critical thinking as more than mere competence in source criticism or what we might call a technical or procedural approach (Hulin, 2018). Critical thinking involves deconstructing the narratives in books, online, and elsewhere, and it must be possible to assess and compare claims against each other, and we need to be able to distinguish between how narratives and history are used and misused. Critical thinking entails seeing things from different perspectives, asking critical questions on distributions of power, and being critical towards how structures and norms in society are established and maintained.

What emerged from the interviews with the pre-service teachers who were still at a relatively early stage of their studies was that most of them thought that critical thinking is largely a matter of source criticism. They were particularly concerned with whether the sources they read, or the author are credible and whether the sources are reliable. This might not be so surprising because they all were introduced to source criticism in the early stage of their teacher education. Most of the pre-service teachers reported that they were familiar with source criticism from secondary school. This understanding was limited compared to how we understand critical thinking or how literature such as Ferrer and Wetlesen (2019) or Rothing (2020) describe it. However, even though most of the

pre-service teachers perceived critical thinking as source criticism, with its more technical or formulaic approach to the sources, some, and especially the more experienced pre-service teachers, recognized that the sources and information they receive represent interpretations and different perspectives on reality. This can be seen as an advanced understanding of critical thinking that is closer to a more critical and reflexive approach as Hulin (2018) and Ferrer and Wetlesen (2019) define it.

How do pre-service teachers understand digital critical competence?

Findings from second-year pre-service teachers

When asked what they think digital critical competence is, most of the pre-service teachers answered that it means having a critical attitude towards digital media. One participant said:

“Personally, I’ve never heard that term before, but I would imagine it means practicing source criticism and using digital resources in a critical way. Being able to think independently about whether what you find online is credible.” Another commented: “and perhaps not using information you find online entirely indiscriminately. If you cannot confirm that it was written by an expert, then maybe it is better not to use this opinion uncritically.” This is in line with how they perceive critical thinking in general, i.e., that it is a technical exercise and basic understanding. The pre-service teachers found the sheer volume of information challenging, and it could be difficult to “get to the bottom” of the information.

“There is simply so much that is written, and you get so many hits for every single search word. And then when different websites say different things, what should we trust, what is correct? For example, if two reputable websites say different things, how are you supposed to know which is right, using the competencies you have? It makes it very challenging.”

One of the more experienced pre-service teachers made an interesting statement, linking this to challenges to democracy:

“We get so much information today that you don’t really have time to be critical.... From a societal perspective, this is incredibly worrying, because we are being bombarded with so much information that is not correct. We do not have time to check any corrections that are added afterwards.... These corrections tend to get overlooked because we’ve already got the information we were looking for. We trust that it’s right... and this, ultimately, poses a threat to democracy. It’s worrying.”

Findings from the experienced pre-service teachers

The fourth-year pre-service teachers linked the concept of digital critical competence to digital education, which encompasses aspects such as qualified judgement, impact assessment, and credibility in addition to elements of source criticism. They were concerned with “how we as teachers handle sensitive information about students.” One of the examples they cited was awareness regarding the use of e-mail for sensitive information in relation to school-home relations. Some

focused on raising awareness amongst pupils on how certain actors on digital platforms can have an agenda for influencing, for example, political issues. Another area has a commercial nature, influencing choices and habits in their favour. They were especially concerned with how so-called “echo chambers” emerged:

“If you, for example, are in an echo-chamber online, you will find support for the information you already have obtained. It can be difficult to judge whether you are inside an echo-chamber or not, and then it will be even more difficult to find if the information you have is realistic or not”.

Discussion: how do pre-service teachers understand digital critical competence?

When it comes to understanding the concept of digital critical competence, the less experienced pre-service teachers found it far more complex than the pre-service teachers expressed in the quantitative survey we conducted earlier (Johanson et al., 2022). In the present study we found that the pre-service teachers expressed difficulties in identifying which sources are credible. In addition, source-critical checking of online sources is time-consuming and resource-intensive. Nevertheless, it seems that they have the tools to do this. Digital critical competence is particularly linked to the vast amount of information available online. In this respect, this kind of an approach corresponds to what we would categorize as a basic understanding of digital critical competence and what Hulin (2018) calls a procedural or technical approach. This involves a formulaic approach to sources and information. However, we regard the pre-service teachers’ ability to recognize that the sheer volume of information can pose a “threat to democracy” as a form of advanced understanding of digital critical competence. This can be interpreted as a critical and reflexive approach. Hulin (2018) points out that it is important to assess, understand, and identify the structure of power. This understanding is in line with Kelentrić et al. (2017, p. 12) and with official policy documents, including the Norwegian curricula for various levels of education.

The more experienced pre-service teachers highlighted the importance of a critical approach to digital learning resources. As expected, these pre-service teachers had other ways of expressing themselves through more advanced use of academic terminology coupled with both theoretical knowledge and personal experience from practice. They related digital critical competence to democracy and citizenship. As one of them put it: “So, digital critical competence is a bit of a step up from digital literacy. It is a step up in terms of being a good citizen.”

When questioning whether the pre-service teachers defined or understood digital critical competence differently from critical thinking, we found that they were somewhat alike as, for example, source criticism. However, evaluating information online is much more complex and challenging because of the vast amount of information on the Internet. Additionally, some worried that the vast amount of information on the Internet is a “threat to democracy.” The more experienced pre-service teachers linked digital critical thinking not only to source criticism, but also to ethics, democracy, and citizenship and to the choice and evaluation of digital tools or

platforms. They expressed that digital critical competence should be a part of digital education in general.

Assessing digital information – a difficult exercise?

Having established how the pre-service teachers understands both critical and digital critical competence, we will discuss how they proceed when they assess digital information.

Findings of second-year pre-service teachers

When we asked the less experienced pre-service teachers to describe how they differentiate between reliable and less reliable sources on the Internet and the process they use to assess online sources, the answers varied. Most of them seemed to understand what a reliable source on the Internet was and they seemed to be equipped with quite high level of skills to find and assess digital information. Several of the pre-service teachers cited examples of what they perceived to be adequate and reliable sources. These included government and public websites such as the Norwegian Ministry of Education and Research and the Norwegian Directorate for Education and Training,³ the national broadcasting company NRK,⁴ the Norwegian Digital Learning Arena (NDLA),⁵ and the Great Norwegian Encyclopedia (SNL).⁶ The commercial television channel TV2 was also regarded as a good source. In addition, the website Forskning.no⁷ was referred to as an adequate source, although the pre-service teacher who mentioned this source pointed out that the website is selective in its interpretation of research when they write an academic article.

“Journalists who refer only to research papers, and articles that are coloured more by the journalist’s opinion of the matter than what the researchers meant. As a result, it becomes more of a populist article. But at least I can look at the references and find the original articles. I’ve done that on several occasions.”

Several of the pre-service teachers gave examples of what they perceived as less reliable sources – usually sensationalist articles or online news outlets that are widely shared on Facebook. Blogs and Wikipedia were also cited as less reliable sources, with statements such as: “I try to use Wikipedia as little as possible” or “we have learned from early age that Wikipedia is not a reliable source.” Another said:

“I remember being taught in middle school, back home ... ‘always be slightly critical towards what you read on Wikipedia. Scroll down and look at the references Wikipedia cites and go directly to those sources’. We were told that the Great Norwegian

3 Ministry of Education and Research and the Norwegian Directorate for Education and Training.

4 Norwegian Broadcasting Corporation.

5 National Digital Learning Arena, which offers open learning resources.

6 Store Norske Leksikon/the Great Norwegian Encyclopedia (SNL): free and publicly available encyclopaedia written by professionals.

7 Forskning.no (2002–present) is an online newspaper about Norwegian and international research.

Encyclopedia (SNL) is a better source than Wikipedia for information on specialist subjects. So that's when I had my first encounter with critical digital thinking and all that."

According to one of the pre-service teachers, these kinds of websites spread a lot of fake news on topics such as dieting and immigration, for example. They pointed out that to check the credibility of the sources, you must "examine what the authors claim very closely by checking references to the original source." Another said: "Who has written it, what they have written, and who has published it are perhaps the three main things to check." One of the interviewees said that importance should be attached to the first impression you get when you go to a website: "The first impression, i.e., how it is structured, in a purely aesthetic sense – and then I think I can distinguish between an adequate source and an inadequate source."

Another pre-service teacher gave an example of searching for a specific topic:

"I was searching for something related to Nazism and stumbled across a website that looked very poorly designed. It appeared to be a right-wing extremist blog, and the content was sheer nonsense, but it looked like the kind of website where information is shared. This was probably an extreme example. While the websites with the best design, such as the Great Norwegian Encyclopedia (SNL) and institutional websites, each tend to have their own distinctive style, I notice how they are organized, since that's what makes the first impression. It's a bonus if the author's name is given at the beginning of a text you're looking at. It helps strengthen the reader's confidence in the website."

An interesting answer that one of the participants gave, and which shows a more advanced understanding of digital critical competence, concerned the use of a noncredible sources, such as sensationalist articles, in a news context. The pre-service teacher stated that this is problematic because this way of writing "pulverizes democracy." According to this pre-service teacher, people who disseminate this type of news are not aware of their role in society. Other pre-service teachers found it difficult to distinguish a reliable source from an inadequate or false source, simply because there is so much information and so many people writing about the same topic, thus making it difficult to sort through it all. Despite this, the pre-service teachers stressed that they are critical of sources, that they check references to the original source, and that they check the academic competence of the author of the text. One of them said that they have a checklist that they run through and that this has now become so ingrained that they do it automatically. They check the address, among other things, to see if there is anyone to contact, "and then I check to see if it looks legit."

Findings of the experienced pre-service teachers

We discussed the differences between reliable and an inadequate or false sources with the more experienced pre-service teachers as well, and how they go about checking this. They felt that their own learning process linked to this was important, primarily to be able to teach pupils "how we can tell that something is not true." Cross-checking information and checking multiple sources were highlighted as important. This is an essential skill because "if you search to find

out whether the Earth is flat, you will always find someone who says the Earth is flat" or, as another put it, "You will always find someone online to support your claim."

They went on to describe the method as checking the origin of websites, checking the text to ascertain whether it is an opinion piece or part of a debate, finding out who the authors of the text are, and checking the bibliography and what references have been used. Where reference is made to previous research, it should be clear which research is being referred to. On websites, checks include assessing the layout, determining whether it is a reliable source (for example, the BBC), or if it is a blog, and they mentioned that influencers can exert a strong influence through blogs or social media posts. It is a matter of trying to judge which interests are behind the various sources, such as whether there are any underlying financial or commercial interests. The interviewees described that it is important to be aware that many websites created by non-experts can look very professional and that it sometimes can be difficult to tell the difference. As some of the pre-service teachers summed it up:

"We talked about what kind of website had posted the information, the purpose behind and goal of this website, and whether there are people or organizations behind the website who want to present their views on a particular topic. You must perform quite a thorough investigation to find out who wrote it."

In this respect, the more experienced pre-service teachers were quite like the second-year pre-service teachers in how they checked whether information or sources are reliable or not. In addition, the group of pre-service teachers reflected on the "echo chamber" effect. According to them, people tend to frequent websites that support the information they have already found. In this context, they pointed out how various news articles, although they may use reliable sources, only present parts of the information to promote their own point of view:

"...articles published in VG [a Norwegian national daily newspaper] promote a specific view. So, they might have given the date, named the author, and provided information about them and all that, and there may well be some sources at the bottom that show where they have got their information from. Those sources might be a PhD thesis, but it is still not necessarily so that the article you are reading is credible. The person concerned may have only cited a few cherry-picked paragraphs from a large thesis that support their point of view and left out points that criticize the views the author wants to promote."

Discussion: is assessing digital information a difficult exercise?

All of the interviewees were able to give examples of what they consider a reliable source and an inadequate source. However, there was quite wide variation in how they go about assessing whether a source is adequate or not. One interviewee said that they adopt a very thorough approach, while others seem to have a slightly vaguer method. This may be related to the background that the pre-service teachers reported they had. In the individual interviews, we got an

impression of the kind of prior knowledge the pre-service teachers had when they embarked on the teacher education programme. Naturally, this prior knowledge varied according to several factors, including age and interest in digital media in general. One of the interviewees had previously worked in the ICT sector, while some had a vocational background. However, all interviewees mentioned lower secondary school and upper secondary school as their most important arena for training related to digital media, with source criticism as the main area they had learned about. Several cited Wikipedia as a concrete example of a source they had learned to be critical towards at school, and they reported that their teachers often mentioned the Great Norwegian Encyclopedia SNL as an example of a more credible source. At the same time, a couple of the interviewees described how they had used Wikipedia as their main source of information in schoolwork without this being corrected. This clear distinction between Wikipedia as an unreliable source and the SNL as a reliable source can serve as an example of a rather unnuanced understanding of what critical digital thinking entails. Critical thinking can involve examining what kind of values are represented in the SNL, thereby raising awareness of the fact that there are multiple ways of describing a phenomenon. The SNL can serve as an example of one of them, and Wikipedia as an example of another. For instance, Brox (2012, 2016) shows in her studies that using Wikipedia in a learning context can contribute to increased critical competence. Through projects where pupils and students themselves contributed to articles on Wikipedia, they became aware of how knowledge is constructed and maintained (Brox, 2012, 2016).

We found that the more experienced pre-service teachers had acquired a more professional vocabulary when using their digital critical competence. They could contextualize knowledge through practice and experience, thus linking it to the school system, teaching profession, parent–home relations, pupils, and learning processes. In other words, they had a more advanced understanding of what critical digital competence entails, more akin to Hulin's (2018) critical and reflexive understanding. In addition, in their development towards becoming a teacher they had gained some professional and academic pegs on which they could hang these concepts.

Even though the second year pre-service teachers' competence could be connected to a more technical understanding of digital critical competence, we found examples of pre-service teachers who had a more critical and reflexive approach, comparable to Hulin's (2018). One example was the pre-service teacher who presented a power-critical view of the role of the media.

Towards a better teacher education?

How can we as providers of teacher education use the experiences we have gained from these surveys to help pre-service teachers develop digital critical competence? When asking pre-service teachers what they miss in their education or would like to learn more about, several of the second-year pre-service teachers responded that they would like more instruction in assessing online sources. They want to learn how to evaluate different types of sources and to develop this digital skill earlier in their studies. In other words, they want more of the kind of formulaic procedural approach to critical digital competence linked to source criticism that is familiar to them from school. This kind of competence is important,

especially in view of the sheer volume of the digital information flow. However, it is important that the pre-service teachers work on acquiring more reflexive critical thinking skills related to digital critical competence. The responses from the fourth-year pre-service teachers indicated that this is something that is being worked on during their education. These more experienced pre-service teachers, but also some of the less experienced pre-service teachers, understood that digital critical competence entails much more than simply running through a source criticism checklist – that it also requires a certain level of critical reflection. The implication for teacher education is that digital critical competence should have a space in all subjects, not just social studies. This will help improve the quality of education and equip the pre-service teachers for everyday life as critical and reflexive teachers.

Conclusion

The point of departure for this study was the question of how the social studies pre-service teachers in the teacher education programme understand and use their own digital critical competence. Our findings shows that the pre-service teachers' understanding of critical thinking as a concept in the early stage of the education is mainly linked to source criticism. Pre-service teachers' conceptual understanding of critical thinking evolves as they progress through the teacher education programme. When it comes to the concept of digital critical competence, most of the second-year pre-service teachers have a technical understanding and are concerned with various challenges, for example, the “enormous volume of information.” Within the frames of Hulin (2018), this can be classified as a procedural understanding of the concept. A procedural approach means acting without any consideration of the underlying intentions; it requires little thought, and cognitive operations are ignored. More experienced pre-service teachers can link digital critical competence more clearly to the teaching profession and the school context and can also reflect on didactic perspectives. They have a more norm-critical approach and question how information and knowledge are established. We find that they have developed a more critical and reflexive approach (Hulin, 2018). A critical and reflexive approach, by contrast, entails assessing and understanding the background for the action, for example, by identifying which power structures have set the premises for action. It is important to develop critical thinking within digital praxis.

It is not unexpected that pre-service teachers develop their competencies at different levels of their teacher education programme. However, our agenda has been to see and reflect on how the pre-service teachers themselves think about and articulate both a procedural and extended competence within the field of critical digital competence. This study can contribute towards a broader and more nuanced understanding of how these social studies pre-service teachers perceive, reflect upon, and develop their own digital critical competencies.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by SIKT-Norwegian Agency for Shared Services in Education and Research. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

References

- Alexander, P. A. (2014). Thinking critically and analytically about critical-analytic thinking: an introduction *Educ. Psychol. Rev.* 26, 469–476. doi: 10.1007/s10648-014-9283-1
- Amdam, S. H., Kobberstad, L. R., and Tikkanen, I. (2022). Professional digital competence in strategy and management: a case study of three teacher education programs in Norway. *Nordic J. Digit. Lit.* 17, 16–30. doi: 10.18261/njdl.17.1.2
- Andresen, J. K., Tømte, C., and Bergan, I. and, Kovac, V. B. (2022). Professional digital competence in initial teacher education: an examination of differences in two cohorts of pre-service teachers *Nordic J. Digit. Lit.* 17, 61–74. doi: 10.18261/njdl.17.1.5
- Bakken, J., and Andersson-Bakken, E. (2021). The textbook as a genre. *J. Curric. Stud.* 53, 729–748. doi: 10.1080/00220272.2021.1929499
- Breakstone, J., Smith, M., Ziv, N., and Wineburg, S. (2022). Civic preparation for the digital age: how college students evaluate online sources about social and political issues. *J. High. Educ.* 93, 963–988. doi: 10.1080/00221546.2022.2082783
- Brox, H. (2012). The elephant in the room: a place for Wikipedia in higher education? *Nordlit.* 16, 143–155. doi: 10.7557/13.2377
- Brox, H. (2016). Troublesome tools: how can Wikipedia editing enhance student teachers' digital skills? *Acta Didactica Norge.* 10, 329–346. doi: 10.5617/adno.2493
- Castellvi, J., Diez-Bedmar, M.-C., and Santisteban, A. (2020). Pre-service teachers' critical digital literacy skills and attitudes to address social problems. *Soc. Sci.* 9, 1–11. doi: 10.3390/socsci9080134
- Creswell, J. W. (2006). "Understanding mixed methods research" in *Designing and Conducting Mixed Methods Research*. eds. J. W. Creswell and V. L. Plano Clark (Thousand Oaks, CA: SAGE Publications)
- Erstad, O., Kjäländer, S., and Järvelä, S. (2021). Facing the challenges of 'digital competence' a Nordics agenda for curriculum development for the 21st century. *Nordic J. Digit. Lit.* 16, 77–87. doi: 10.18261/issn.1891-943x-2021-02-04
- Ferguson, L. E., and Krangle, I. (2020). Hvordan fremme kritisk tenkning i grunnskolen? *Norsk Pedagogisk Tidsskrift.* 2, 194–205. doi: 10.18261/issn.1504-2987-2020-02-09
- Ferrer, M., and Wetlesen, A. (eds.) (2019). *Kritisk Tenkning i Samfunnsfag*. Oslo: Universitetsforlaget.
- Grut, S. (2021). *Digital Kildekritikk*. Oslo: Gyldendal Norsk Forlag AS.
- Gudmundsdottir, G. B., and Hatlevik, O. E. (2020). "I just Google it" – developing professional digital competence and preparing student teachers to exercise responsible ICT use. *Nordic J. Comp. Int. Educ.* 4, 39–35. doi: 10.7577/njcie.375
- Hammersley, M., and Atkinson, P. (1996). *Feltmetodikk. Grunnlaget for Feltarbeid og Feltforskning*. Oslo: Ad Notam Gyldendal.
- Hulin, T. (2018). How critical thinking should be at the heart of digital interactions? *J. Commun. Stud.* 11, 85–105.
- Instefjord, E. J. (2018). Professional Digital Competence in Teacher Education: A Mixed Methods Study of the Emphasis on and Integration of Professional Digital Competence in Teacher Education [Doctoral Dissertation, University of Stavanger]. Available at: https://uis.brage.unit.no/uisxmlui/bitstream/handle/11250/2501440/Elen_J_Instefjord.pdf?sequence=1&isAllowed=y (Accessed March 01, 2023).
- Instefjord, E. J., and Munthe, E. (2017). Education digitally competent teachers: a study of integration of professional digital competence in teacher education. *Teach. Educ.* 67, 37–45. doi: 10.1016/j.tate.2017.05.016
- Johanson, L. B., Leming, T., Johannessen, B.-H., and Solhaug, T. (2022). Competence in digital interaction and communication – a study of first-year preservice teachers' competence in digital interaction and communication at the start of their teacher education. *Teach. Educ.* 58, 270–288. doi: 10.1080/08878730.2022.2122095
- Joint Research Centre, Institute for Prospective Technological Studies, and Ferrari, A. (2012). *Digital competence in practice: an analysis of frameworks*. Publications Office. Available at: <https://data.europa.eu/doi/10.2791/82116>
- Kampylis, P., Punie, Y., and Devine, J. (2015). *Promoting effective digital-age learning: a European framework for digitally-competent educational organisations*, EUR 27599 EN. Luxembourg: Publications Office of the European Union.
- Kelentrić, M., Helland, K., and Arstorp, A.-T. (2017). Rammeverk for Lærere profesjonsfaglige Digital Kompetanse. Senter for IKT i Utdanningen. Available at: <https://www.udir.no/contentassets/081d3aef2e4747b096387aba163691e4/pfdk-rammeverk-2018.pdf>, (Accessed March 01, 2023)
- Krumsvik, R. (2022). Digital competence across the education and health sector. *Nordic J. Digit. Lit.* 17, 149–154. doi: 10.18261/njdl.17.3.1
- Langset, I. D., Jacobsen, D. Y., and Haugsbakken, H. (2018). Digital professional development: towards a collaborative learning approach for taking higher education into the digitalized age. *Nordic J. Digit. Lit.* 13, 24–39. doi: 10.18261/ISSN.1891-943X-2018-01-03
- Lim, L. (2015). Critical thinking, social education and the curriculum: foregrounding a social and relational epistemology. *Curriculum J.* 26, 4–23. doi: 10.1080/09585176.2014.975733
- Mattar, J., Santos, C. C., and Cuque, L. M. (2022). Analysis and comparison of international digital competence frameworks for education. *Educ. Sci.* 12:932. doi: 10.3390/educsci12120932
- McGrew, S., Breakstone, J., Ortega, T., Smith, M., and Wineburg, S. (2018). Can students evaluate online sources? Learning from assessments of civic online reasoning. *Theory Res. Soc. Educ.* 46, 165–193. doi: 10.1080/00933104.2017.1416320
- Mikkelsen, R., and Rist, M. (2018). "Lærerstudenters digitale praksismøte [when preservice teachers encounter digital praxis]" in *Restart: Å Være Digital i Skole og Utdanning*. eds. L. B. Johanson and S. S. Karlsen (Oslo: Universitetsforlaget), 163–177.
- Nascimbeni, F., and Vosloo, S. (2019). Digital Literacy for Children: Exploring Definitions and Frameworks. UNICEF Office of Global Insight and Policy. Available at: <https://www.unicef.org/globalinsight/media/1271/file/%20UNICEF-Globa-Insight-digital-literacy-scoping-paper-2020.pdf>, (Accessed March 01, 2023)
- Norwegian Directorate for Education and Training (2017). Core Curriculum – Values and Principles for Primary and Secondary Education. Available at: <https://file:///C:/Users/Jjo053/Downloads/Overordnet%20del%20p%C3%A5%20engelsk.pdf> (Accessed March 01, 2023)
- Norwegian Directorate for Education and Training (2020). Curriculum for Social Studies (SAF01-04). Available at: <https://www.udir.no/lk20/saf01-04?lang=eng> (Accessed March 01, 2023)
- Official Norwegian Reports NOU (2015). The School of the Future – Renewal of Subjects and Competences. Available at: <https://www.regjeringen.no/en/dokumenter/nou-2015-8/id2417001/> (Accessed March 01, 2023)
- Programme Description (2022). Studieplan. Master i Grunnskolelærerutdanning for 5.10. UiT Norges Arktiske Universitet. Available at: <https://uit.no/Content/729822/cache=2022260903702/studieplan%205-10.pdf> (Accessed March 01, 2023)

Conflict of interest

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

Røthing, Å. (2020). *Mangfoldskompetanse og Kritisk Tenkning*. Oslo: Cappelen Damm Akademisk.

Ryen, E., Jøsok, E., Jegstad, K. M., and Sandvik, M. (2019). Kritisk Tenkning. *Bedre Skole*, 31. Available at: <https://utdanningsforskning.no/artikler/2019/kritisk-tenkning/> (Accessed March 01, 2023)

Tjora, A. (2018). *Viten Skapt – Kvalitativ Analyse og Teoriutvikling*. Oslo: Cappelen Damm Akademisk.

Tjora, A. (2021). *Kvalitative Forskningsmetoder I Praksis*. Oslo: Gyldendal Akademisk.

Weyergang, C., and Frønes, T. S. (2020). “Å lese kritisk: Elevers vurderinger av teksters troverdighet og pålitelighet” in *Like Muligheter Til God Leseferdighet? 20 år Med Lesing i PISA*. eds. I. C. Weyergang and T. S. Frønes (Oslo: Universitetsforlaget), 166–195.