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Physiotherapy Students' Shaping of Digital Learning Practices: Characteristics, Opportunities and Challenges

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Abstract
The digital competence of higher education students is an increasingly researched area. Research has shown that students generally have a basic level of digital competence, and that digital competence is crucial for universities to effectively adapt to educational models and in the curricula. Physiotherapy education is a health education study programme that relies heavily on practical competence domains, such as ethical and professional practice, communication, evidence-based practice, interprofessional teamwork, leadership, and teamwork. In 2008, a European multidimensional conceptual framework for digital competence in schools was launched. The framework comprises technological, cognitive, ethical and integration dimensions. There is currently a paucity of research on how higher education students act as digital learners and how they view the relevance of using technology in their study programmes. The aim of this qualitative study was to investigate the characteristics of physiotherapy students' digital learning practices, and how they position their opinions on the relevance of digital education and the practice in their studies. This study had a qualitative design, and was based on individual interviews with eleven students at four Norwegian physiotherapy education institutions. The interviews were analysed using thematic analysis. The characteristics show that physiotherapy students adapt to, utilize, and have experiences with digital technology across diverse learning contexts facilitated by teachers, self-directed learning, and peer collaboration. The main themes that emerged from the analysis were the students' shaping of an informal digital learning practice, and their ambiguity in aligning their digital learning practice with the practical competence domains in their study programmes. In conclusion, the present study shows that, although physiotherapy students adapt, utilize and experiences digital technology in various learning contexts, and develop informal digital learning practices which are collaborative by their nature. This does not align with the existing practice competence dimensions of their study programmes. As covered by the integration of dimensions in the European digital competence framework, students were unable to link their digital learning practices in their study programmes to clinical workplace demands. The present findings support strengthening institutional responsibilities for implementing teaching schedules for digital competence in education. Further efforts should be made to investigate whether the findings are representative of students in other higher education disciplines.

Keywords
digital competence, digital learning, physiotherapy education, informal learning

Introduction
Since 2006, the European Commission has promoted digital competence as one of eight key competencies for lifelong learning (EU, 2019; Vuorikari, et al., 2022). Digital competence involves the confident, critical and responsible use of and engagement with digital technologies for learning, at work and for participation in society (EU, 2019). In the *Digital Education*

Action Plan 2021–2027 of the EU Commission, the enhancement of digital competences for digital transformation is one of two strategic priorities (EU, 2021). Consistent with the considerable efforts by the European Commission in this field, recent Norwegian white papers have highlighted the need for pedagogical approaches to facilitate future work-relevant skills, such as problem solving, collaboration, creativity and digital competence (Ministery of Education and Research, 2021; Norwegian Directorate for Higher Education and Skills, 2022; NOU 2019:2, 2019).

In 2008, a European multi-dimensional framework for digital competence in schools was published (Calvani, et al., 2008). The framework included four dimensions: technological (being able to explore and face problems and new technological contexts in a flexible way), cognitive (to read, select, interpret and evaluate data and information, taking into account their pertinence and reliability), ethical (to interact with other individuals constructively and with a sense of responsibility using available technologies), and integrative (understanding the potential offered by technologies that enable individuals to share information and build new knowledge collaboratively) (Calvani, et al., 2008).

A recent systematic literature review on digital competence in higher education research revealed a burgeoning interest in topics concerning digital competence within higher education settings (Zhao, et al., 2021). Among the 33 studies included in the review, the majority (61%) focused on assessing the digital competence levels of students or teachers (Zhao, et al., 2021). The results indicated that participants generally possessed only a basic level of digital competence. In light of these findings, the authors recommended directing greater attention towards employing suitable pedagogical approaches that promote digital competence (Zhao, et al., 2021). This emphasis on digital competence is crucial for universities to effectively adapt to educational models and in the curricula. Another systematic literature review on the digital competence of university students discovered that the majority of studies expressed doubts about students' proficiency in digital competence, contrary to what was assumed (Sánchez-Caballé, et al., 2020). Consequently, the authors argued that universities bear the responsibility of assisting students in developing this competence (Sánchez-Caballé, et al., 2020). Two other studies, one from Spanish teacher education and another from university students in the UK, concluded that there was little transferal between students' digital competence developed in informal and formal learning contexts (Costa, et al., 2018; Guzmán-Simón, et al., 2017).

It has been argued that a systematic integration of digital competence in health education can significantly contribute to the health sector and the population's attainment of digital health competence (Krumsvik, 2022). Physiotherapy education, as a programme in health education, heavily relies on practical competence domains, such as ethical and professional practice, communication, evidence-based practice, interprofessional teamwork, leadership, and teamwork (World Confederation for Physicaltherapy (WCPT), 2021)). Amid the COVID-19 pandemic, the WCPT and International Network of Physiotherapy Regulatory Authorities (INPTRA) released a report underscoring the importance of digital physiotherapy practice. The report emphasized the potential of modern technologies and digital practices in enabling effective and impactful engagement with diverse audiences (WCPT & INPTRA, 2020).

Review findings on the use of technology in physiotherapy education have indicated the application of various digital technologies in different learning and teaching contexts. These include feedback and assessment, clinical skills and techniques, and professional behaviours (Mącznik, et al., 2015; Olivier, et al., 2020; Ødegaard, et al., 2022). Despite the growing body of literature on digital education in physiotherapy education, there is a lack of research

investigating how health education students utilize technology in their learning, and to what extent they connect it to their clinical work as health professionals.

So far it has been claimed that technology use in physiotherapy education contributes to increasing the cost-effectiveness and efficiency of information delivery, rather than to developing transformative digital learning practices (Rowe, 2018). The proximity to increasingly digitalised healthcare makes physiotherapy education an interesting case for exploring the digital competence of higher education students. The aim of this qualitative study was to investigate the characteristics of physiotherapy students' digital learning practices, how they position these practices in their studies, and their opinions on the relevance of digital education in their study programmes.

Methods

This was a qualitative study with individual in-depth interviews. Ethical approval was received from the Norwegian Centre for Research Data (NSD); reference number 862743. The study was conducted according to OsloMet (Oslo Metropolitan University)'s institutional research regulations.

Recruiting participants

The participating students were recruited from four different Norwegian physiotherapy study programmes. Efforts were made to recruit students at both undergraduate and graduate levels of physiotherapy education. To recruit students for the study, first the heads of departments were informed of the study, and they gave their consent that staff members could be contacted in the recruitment process. Thereafter, one of the authors (Ødegaard) directly contacted course leaders in the physiotherapy programmes. Based on subsequent invitations, she was invited to present the study directly to students in a formal educational setting.

To increase the students' motivation to participate, an animation video with information about the study was developed: https://youtu.be/-EzuVnZdczI. Based on the recruitment efforts, a total of 11 students were included.

Interviews

Before conducting the interviews, a semi-structured interview guide was developed. The topics in the guide were informed by the dimensions of the Digital Competence at School Framework (Calvani, et al., 2008). The use of a semi-structured interview guide allows for openness for the participants to address themes with which they are engaged, thereby allowing for a certain variation among the interviews (Kvale & Brinkmann, 2015). Before the interviews took place, the interview guide was piloted and refined based on testing on three students who participated in a master's level course. The final interview guide is attached in Appendix 1. The interviews were conducted between June and December 2021, using Zoom software: <https://zoom.us/>. The interviews lasted for an average of 60 minutes and were conducted by the same researcher (Ødegaard). Based on a consideration that it was unlikely that gathering additional data would yield novel insight or information, we determined data saturation after conducting 11 interviews (Kvale & Brinkmann, 2015).

Analysis

In the analysis of the data in this study, we searched for common or shared meanings in understanding the student's experiences and thoughts across the dataset, using the six steps in thematic analysis (Braun & Clarke, 2006). The aim of our study was to explore the digital learning practices of physiotherapy students. We sought to understand how these students incorporate these practices into their studies, and their perspectives on the significance of digital education within their study programmes. In conducting our analysis, we relied upon the conceptual framework of Calvani, et al. (2008).

The interviews were transcribed by an external transcriber prior to analysis, and the first author (Ødegaard) carried out the initial analysis by pen and paper, scratching out initial ideas. In the first step the first author familiarized with the data, by reading the text, rereading of data, noting of initial ideas, and searching for unique sides, and then starting to understand the meanings in the data. In the second step, collation codes and data extracts were generated by the first author by using NVivo and identifying features of the data set. These results were discussed with the third author (Røe). In the third step, the first author searched for themes by examining the codes and data discussed by the first and third authors (Ødegaard and Røe). After familiarizing themselves with the transcribed interviews, the authors worked collaboratively in the further analysis of the data and the process of reviewing themes. We made the decision to discontinue the use of NVivo, as we found its tools unsuitable for effective collaboration. Instead, we opted to employ pen and paper and Word documents for our subsequent analysis. The fourth step was the process of defining and making informative naming for each theme. This process included several meetings over a period of 9 months. The second author (Dahl-Michelsen) joined the other two in analysis meetings. In these meetings, we discussed questions that occurred during the analysis. To achieve variation in interpretation of codes and themes, they were in line with Brown and Clarke recommendations, comprehensively discussed (Braun & Clarke, 2006). In the fifth step, the interpretation of the results was discussed in two meetings with two different research groups in which all the authors participated.

Also, this approach contributed to the validation of the interpretation of the empirical data. Lastly, a report was set up, and the writing up included a final analysis in relation to the research literature.

Results

The results reveal the ways in which students adapt to and utilize digital technology in various learning contexts, as well as their experiences with digital learning facilitated by teachers, self-directed learning, and peer collaboration. Students employ a diverse range of digital technologies, particularly in pre-class and after class learning scenarios, selecting different tools and formats to enhance their learning experience. The first author has extracted and synthesized these results the interview data, reflecting the students' own expressions. The identified characteristics are organized and presented in Table 1 below.

Table 1 The participants' characteristics

Participant	Gender	Years of study experience	Study year (study in progress)	Learning context and type of digital technology	Experiences with digital learning
1	Female	5 years	Finished 2nd year bachelor's/ under-graduate level	Chosen by the student Pre-class Not mentioned In class Not mentioned After class Repetition, always use PC; access to everything, Canvas, Podcasts, groupwork: Google Docs, Google slides Produce videos in groups, Websites, e.g., The Norwegian Electronic Health Library (Helsebiblioteket.no), Norsk helseinformatikk (NHI)	Producing videos with peers, different technical competence in the group, time consuming Self-produced videos as repetitions before assessment situations Websites – use a priori knowledge to assess the quality of the websites
2	Female	5.5 years	Finished 2nd year bachelor's/ under-graduate level	Chosen by the student Pre-class Podcasts, Google search, videos In class Not mentioned After class Google Docs (assessment context), videos, podcasts, Zoom, Canvas, Messenger, Snapchat, Zoom, Google search; sharing pictures, videos and podcasts with peers	Collaborative and interactive learning Self-chosen digital groups and distribution of roles in writing together Various digital information and resources – multiple approaches on the subject, explanations in several ways
3	Female	7 years	Finished 2nd year bachelor's/ under-graduate level	Chosen by the student Pre-class Podcast In class Not mentioned After class Podcast, Google Docs, online Word, Zoom, Digital papers, Podcast	Digital learning materials (especially short videos) to understand better what is described in books, sharing in groups, e.g., podcasts; VR – positive related to practices practical skills Co-writing using Google Docs and online Word Need for clear expectations on sharing and recording from teaching situations
4	Female	5.5 years	Finished 2ndyear bachelor's/ under-graduate level	Chosen by the student Pre-class Video and podcast In class Not mentioned After class Video and podcast	Podcast and videos as basic understanding; collaborative and interactive learning; meeting and writing on Zoom – collaboration, self-chosen groups; sharing digital learning recourses in groups, e.g., Messenger group

Participant	Gender	Years of study experience	Study year (study in progress)	Learning context and type of digital technology	Experiences with digital learning
5	Male	1 year	In 2nd year bachelor's/ under-graduate level	Chosen by the student Pre-class Syllabus In class Digital presentations in the class (e.g., PowerPoint), After class Cloud based tools; Google Docs, Zoom meetings Videos (e.g., YouTube, to watch basic skills)	Flexibility: time and place, own tempo/speed, timesaving Prefer teaching in how and what to use of digital tools; Kahoot; repetition and trigger/ boost; get feedback Do not share digital materials with other students (individually), except when they are in a group Cloud based tools – collaborative and interactive learning -working on exams questions together; sharing and helping each other
6	Male	3 years	In 1st year master's level	Chosen by the student Pre-class Watching short videos In class Not mentioned After class Searching on Google, Using Google Docs	Flexibility, timesaving; watching short videos first (as introduction and to be efficient). Visualizing the topics. Easer to focus on short videos; answering quizzes – immediate feedback and efficient regardless of time or location; digital self-chosen groups; collaboration on acquiring learning outcomes in cloud-based tools. Discussions subjects in digital groups – efficiency; peers helping each other on technical issues; sharing documents, podcast, videos, Messenger and Snapchat - sharing resources
7	Female	4 years	In 1st year master's level	Chosen by the student Pre-class Podcasts In class Not mentioned After class Podcasts, YouTube videos, Google Docs, Google search, Search in databases	Podcasts and videos – known sources to use, not a serious reference – a possibility to get it explained differently or read it in different ways Digital group assessment – time consuming; the dynamic in the digital group: need to share some personal issues as well; sharing with peers; websites, podcasts, videos – not seen as a polite reference; digital tools and resources sharing from the education – trustworthiness

Participant	Gender	Years of study experience	Study year (study in progress)	Learning context and type of digital technology	Experiences with digital learning
8	Female	4 years	In 1st year master's level	Chosen by the student Pre-class Reading, videos In class Not mentioned After class Facebook, Messenger, Search in Google and watching YouTube videos or digital lectures	Digital collaboration: writing notes from the teaching in shared documents; use Google and YouTube to better understand; need clear expectations from the education related to using digital tools in tasks Digital challenges: Time – organizing and ending at time schedule; technical issues; cohesion with peers. Positive: Flexibility; easy access to digital information outside the educational context as well and being prepared for future work
9	Male	2 years	In 3rd year bachelor's/ under-graduate level	Chosen by the student Pre-class Not mentioned In class Not mentioned After class Google Docs, Dictionary, YouTube, Messenger, TikTok	Technical skilled, searches for answers online; co-writing in field reports: students choose the software themselves; digital learning resources – better understanding of the knowledge; learning strategy: notes, video - combine the visuals and text. Sharing with peers
10	Male		In 1st year master's level	Chosen by the student Pre-class Not mentioned In class Not mentioned After class Using recorded lectures, Search in Google and PubMed, Dropbox	Flexibility, timesaving. efficiency, more structure; quiet environment – ability to concentrate Reading syllabus, watching videos, better explanations Helping each other with digital issues Need for more digital competence – sharing digital materials and where to share it. Concerns related to digitalization – a need to touch and see the patient in real life – a good mix of the digital and physical.

Participant	Gender	Years of study experience	Study year (study in progress)	Learning context and type of digital technology	Experiences with digital learning
11	Female	2.5 years	In 3rd year bachelor's/ under-graduate level	Chosen by the student Pre-class Wrights notes in the PowerPoint presentations Co-writing; preparation for seminars/groups; pp-presentation, sharing ideas, structured from the education In class Writing notes on PowerPoint presentations After class Write notes in notebook and on PC, Watching video. Google Docs, search in Google	Combining notes, video, and discussions; Mind Maps – right to learn the subject, thereafter discussions and watching videos. Search for video first then podcast Struggling to find a podcast that explains exactly what you need co-writing in shared documents Established groups at campus – transferring to digital groups Skeptical to doing digital physiotherapy; need to communicate face-to-face with patient as a starting point, later on digital consultations. The students need to be prepared to facilitate digital physiotherapy in the education programme.Think that learning through VR technology must be fantastic

In summary, characteristics show that the students use various digital technology and learning resources to observe practical skills, listen to podcasts and write notes and tasks. Writing together in Google Docs seems to be a widespread practice, as well as listening to podcasts and watching YouTube videos. Characteristics in Table 1 show that students have a self-directed learning approach, reflecting that the students take the responsibility for learning in such contexts, both on their own and together with peers. The characteristics of experiences show that students utilize digital technology to enrich their learning and to enhance understanding of the subject matter. Notably, the experiences of using digital technology reflects independence and additional activity not facilitated by the education.

The outcome of the thematic analysis of the students' accounts can be summarised into two main themes and five sub-themes, as displayed in Table 2. In the subsequent paragraphs, these results are explained in more detail, and illustrated with citations from the interviews.

Table 2 Summary of Main and Sub-Themes of the Students' Accounts

Main themes	**Sub-themes**
Shaping of informal digital learning practices	· Students' confidence in their technological skills · Combining different digital formats to increase learning · Collaborative elements in digital work
Students' ambiguity in positioning their digital learning practices	· Reliability and pertinence of digital formats · Challenges in aligning students' digital learning practices with existing practice competence domains · Limited linkages between current digital learning practices and clinical skills

Shaping of informal digital learning practices

As indicated by the work of the EU Commission, digital competence in education is a multi-dimensional endeavour (Calvani, et al., 2008). Drawing on this framework, the student participants displayed confidence in their technological skills as part of a generation that has grown up with digital technology:

> I think that my generation… grew up with technology. So, for most, I think it is pretty simple to use. I, at least, have had few problems with it… I think it is integrated in the DNA among most… and that in our generation, it is something taken for granted. (Student 2)

Despite this, the students' experience was that those technical skills varied between their peers. Where this was the case, the students described practice in which they helped and supported each other, and were able to distribute tasks among themselves based on other students' more specialised technical skills:

> Nowadays, there åre many people on social media who like producing videos and films, so both of my groups have had at least one member who has previously created film content and enjoys working with it. (Student 1)

A sub-theme from the interviews was how the students used different digital formats by themselves, depending on the educational context and purpose. In addition, this digital informal learning practice was often used as a supplement to formal learning activities, to better understand content and enhance learning outcomes. Another benefit of drawing on the use of visualised elements was the ability to combine different elements to better understand the subject. This learning practice was used first and foremost in acquiring knowledge in theoretical subjects. As two students said:

> First, I use the video lectures to navigate the syllabus, that is, to find my way into the teaching material. Thereafter, I read the syllabus and go through the video. Maybe I can get more in-depth knowledge about things previously unclear, and see if they explain it clearly and useful for me. (Student 10)
>
> As it often goes with videos, such as with physical examination skills in physiotherapy, it is as much about the advantage of having a video that explains both visually and in speech… instead of having a book with three images. (Student 6)

In their search for relevant digital learning materials, several students referred to podcasts as a useful resource. However, their accounts indicated that they used podcasts for motivation and inspiration rather than legitimate learning resources:

> Recently, I listened to a really interesting podcast and thereafter shared it with a friend. Then, we reflected on who was creating this podcast, what its purpose is, and what knowledge is it based on? However, it doesn't necessarily count as an additional source in a way. Rather, it is for inspiration and for afterthoughts rather than actual professional knowledge. (Student 6)

In addition, the opportunity to listen to podcasts while doing other activities was put forward as an advantage:

> I started listening to more podcasts because I figured out that it was an efficient way for me to learn. I prefer to go out to do something… then, in a way, I can do other things while simultaneously listening to a podcast. (Student 1)

As previously mentioned, the students also worked together on technical issues. Other collaborative activities were described as working synchronously on documents in the teaching situation to build knowledge together. Another practice involved sharing information with fellow students using social media platforms. The following citation from a student illustrates how Google Docs was used in co-writing:

> I find Google Docs rather straightforward. Further, even more useful, combined with Zoom meeting with peers. Then everyone has access to instantly write, edit and capture things as they happen in the moment. There, I think Google Docs is almost better than an in-person meeting. (Student 2)

Another student explained how they had collaborated on a shared document in preparation for an exam by first working individually on the shared document and then having plenary discussions on peers' content creation:

> In the first semester, we had a group exam, and then we very actively used a cloud document. And it was great. We did that for the exam practice as well. We were given a list of questions or topics that appeared on the exam and questions for them. And then we divided up some of the questions individually, and then we wrote the answers out for ourselves, and then we pasted them into the cloud document so that everyone could access the answers.. And everyone did this, so then we had the complete answer that they [the teachers in the study programme]were actually looking for. (Student 5)

Nevertheless, according to the effectiveness in terms of time savings, critical voices were also raised regarding co-writing in cloud-based documents. This could reflect the viewpoints of students with a higher quality of readiness and ambitions than other fellow students:

> I always end up rewriting the entire thing because people write differently. I know that I have very high standards for which sources I use, while others like to use Physiopedia [laughs] and sources they have found on Google. So, it very often ends up that I have to sit down and rewrite the whole thing. So I don't know if it saves me that much time. (Student 3)

As expected, the students' stories showed that they saw certain obvious advantages in the flexibility offered by digital technologies, such as access to multiple sources of information and increased opportunities to combine studying with paid work or leisure activities. Increased access was described as contributing to enhancing learning:

> I think I have experienced more learning because there is so much access to a lot of information. That, if you have a textbook on something, it's very… regardless of who wrote it, it often becomes a bit biased or you get a bit of a subjective feeling from the book. So, I feel that with digital resources and the Web, you can get a few more angles on it. So, I think I have learned more or that it is easier to learn because it can be explained in several ways. (Student 2)

Nevertheless, it is also worth noting that they foresaw this as something that required increased self-discipline in studying. As one of the students claimed:

> They [the study programme] offer great flexibility, and so I want to make this the main thing in my life now, and then I have the opportunity to do a lot of work. I have a lot to work with and build up to physical attendance. It does not require me to be in on a fixed day and attend a lecture. I can work as much as I want. But, of course, it is a big responsibility, and the pitfall is that when you get to school, then there are many who may not have done their jobs. (Student 6)

As indicated by these accounts, the students have high confidence in their technological skills and have developed an informal digital practice in which they combine knowledge from several sources. In addition, their digital practice is characterised by a collaborative culture with sharing of expertise.

Students' ambiguity in positioning their digital learning practices

The students' accounts indicated that they had problems aligning their digital learning practices with existing practical competence domains in the programme. In most cases, this seemed to be related to accessing and judging the reliability and pertinence of the research findings. The challenges that the students faced according to this type of quality appraisal are underlined by the following citation:

> If you search Norwegian databases or in Norwegian on Google, you may understand it better without necessarily knowing the weight or quality of what is written there. It's not something I check every now and then, but I do check the author and what the author's profession is to assess whether there is any weight to this. However, it is very difficult to know what is acceptable and what is not. (Student 7)

Interestingly, the students explained how they were trained to identify reliable research-based information as part of a lesson in evidence-based practice. One of the students explained how she had been taught by a research librarian as part of the training in evidence-based practice:

> When it comes to literature and research-based knowledge, I feel that we have received good training to be critical of things. I feel that has been a consistent focus… We have learned that some sources are more reliable than others, and it has been quite clear from the start that you use the Norwegian Electronic Health Library [a Norwegian public quality assured database with health information] rather than a normal Google search. I feel, at least in my generation and the younger generation, that we have gradually become very critical of sources during our studies. We are critical, but we may not necessarily know exactly how to sort through all the information that is out there other than using the channels that someone has told us are trustworthy. (Student 6)

From this citation, there was a clear indication that the students seemed to judge what constitutes legitimate digital sources. The contrast to their previous digital learning experiences from school was illustrated by the following citation:

> In our education, we learned about this through literature searches and source criticism. When I had to figure things out on my own, I think through all the years since elementary school we

> have used PCs and digital tools, so I just think it has become a habit to try to find videos. I also know there are a lot of good YouTube videos and good lecturers who are good at digital, so I know there is a lot of good out there too. (Student 8)

This lack of alignment resulted in difficulties navigating information in formal assessment arenas, such as an exam:

> In a way, it is up to us what kind of additional information we acquire. But then you know that you cannot include it as a possible source in an exam. And then, I also feel that the teachers I have are able to distinguish between whether this is a compulsory syllabus or just some additional information, and perhaps when there is additional information, you understand that this cannot be used as a basis for that information in an exam. (Student 7)

The students' accounts of the link between their current use of technology in learning and their clinical practices were rather limited. One exception was how a student drew a line from their current digital searching habits, with the ability to stay updated during and after their studies:

> Yes, I would say it's an advantage that a lot is digitized now. Keeping up to date after the course, then you are very much on your own, and if you develop a very good routine and good training during the course, then I see that as a great advantage. Perhaps this will make physiotherapists better able to keep up to date when they go out to work. Then they are in a way experienced in where to look for information and perhaps have established digital collaboration groups or, yes, that they are used to this throughout the course of the study, that it is maintained after the course as well. (Student 8)

The dominant picture provided by their accounts, however, was that they saw little connection between using digital technology in theoretical learning and clinical practice. Several students saw this as being among the cultural traits, within physiotherapy, of therapeutic touch and interacting face-to-face with patients. This was illustrated by one student, who reflected on the use of technology in the professional, clinical field, and considered this topic to be difficult to imagine:

> I don't quite see the purpose of using it in my professional field (…), but if one can, in a way, know how joints should feel with the help of technological tools, if, in a way, that is the technical way one should conduct the functional assessment, yes, maybe it would be interesting. But it's, kind of, outside my sphere of thought. (Student 7)

Discussion

This study investigated the characteristics of physiotherapy students' digital learning practices, how they position their practices in their studies, and their opinions on the relevance of digital education in their study programmes. The characteristics show that the students use various forms of digital technology to strengthen their learning, for example, by video observation of practical skills, by listening to podcasts, and by using cloud-based software to take notes and do tasks to enrich their learning; this reflects self-directed learning. This may also reflect that the education, to a limited extent, facilitates pedagogical use of digital technology in the teaching approaches. In a traditional teaching approach in physiotherapy

education, such as lectures, and bodily knowing and competence, the potential for facilitating digital learning for the students is not exploited. This is in line with a study on physiotherapy teachers' perceptions on digital education, and might explain some of the teachers' hesitance to implement digital education (Ødegaard, et al., 2022).

Thus, a main result was that the students shaped informal digital learning practices with distinct features, such as collaborative working and the sharing of experiences.

Nevertheless, despite some positive attributes, the students struggled to position their informal digital practices against existing practice competence dimensions in the study programme. According to their accounts, particular conflicts occurred between their recreational digital search methods and the strict requirements used in searching and assuring the quality of evidence-based practice.

As a result of this confusion, their informal digital practices were delineated as supplementary to traditional learning in the study programme. Based on the significant implementation of digital technology in physiotherapy education (Ødegaard, et al., 2021), students' accounts of the lack of teaching on the subject of digital learning in the current study were surprising. As such, the current findings support the need for institutional implementation of digital competence in study programmes (Costa, et al., 2018; EU, 2021; Guzmán-Simón, et al., 2017; Ministry of Education and Research, 2021; Zhao et al., 2021). Nevertheless, the lack of competence of teachers, in the educational use of technology and innovation of teaching practices, has been well documented (Børte, et al., 2020). Thus, we strongly advocate that, in efforts to promote digital competence, institutions should take a holistic approach that includes relevant elements of the organisation. This holistic approach contents of n institutional pedagogical and digital strategy, rooted in the management approach, digital support, pedagogical approaches facilitating acquisition of digital competence as integrated in the study programme, and finally, the strengthening of teachers' digital competence.

According to the framework provided by the European Commission, digital competence in schools is characterised by the co-existence and integration of technological, cognitive and ethical skill sets (Calvani, et al., 2008). We found indications that the students' technological confidence was rather high, and that they were able to benefit as a group from the advanced technological skills of some students. This was also seen in other studies on students' digital informal learning profiles, which showed that students have technical skills, although they need to improve their information and multimedia competences (Ozdamar-Keskin, et al., 2015). In addition, the students' accounts, of how they were able to read, select and constructively interact with other students digitally, indicate that their digital competency is at an acceptable level regarding the cognitive and ethical dimensions of the European framework (Calvani, et al., 2008). In contrast, their accounts indicated that there are challenges regarding the integration of the dimensions in the framework, as displayed by their lack of understanding of the potential offered by technologies for their future work as physiotherapists and for building new knowledge (Calvani, et al., 2008). We argue that just the integration of these dimensions is necessary to apply and utilize technologies in real-world clinical settings.

Physiotherapy education has been an early adopter of digital technology in education, and must prepare candidates for autonomous clinical work in which they need to supervise patients in making daily health choices (WCPT, 2021). During the COVID-19 pandemic, the future role of technology in the transformation of the physiotherapy profession was debated, and physiotherapists are increasingly implementing communication technology, such as video consultations, in their clinical practice (Nicholls, et al., 2020). Due to this connection to workplace demands, we believe that physiotherapy education constitutes an interesting case for investigating digital competence among higher education students across higher education disciplines.

This study has some limitations that should be noted. First, the data were collected within the context of the Covid-19 pandemic. Although it is difficult to fully understand the implications of this, the lack of face-to-face interaction with fellow students during this period may have influenced the students' opinions on digital education. In addition, while aiming to be generalised to higher education, the study took place only in Norwegian physiotherapy education. Nevertheless, this case is part of the ongoing long-term debate and considerable research on digital transformation in Norwegian physiotherapy education.

Conclusions

The current study demonstrates that physiotherapy students adapt to, utilize, and have experiences with digital technology across diverse learning contexts. The development of informal digital learning practices is found to be collaborative in nature. However, these practices do not align with the existing practice competence dimensions within the students' study programmes. This misalignment becomes evident when considering the integration of dimensions outlined in the European digital competence framework. Students struggle to establish connections between their digital learning practices and the demands of the clinical workplace. These results underscore the importance of strengthening institutional responsibilities for incorporating digital competence into educational curricula. Furthermore, it is crucial to conduct further investigations, to determine whether these findings are representative of students in other higher education disciplines.

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