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Unravelling the digital competence of students in physiotherapy education through the European digital competence framework

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ABSTRACT

Purpose: To describe the distribution and extent of the physiotherapy students' digital competence, using the European Digital Competence Framework (DigComp).

Materials and methods: Two focus group interviews with second-year students enrolled in a Physiotherapy Bachelor study program were conducted. Meaningful units from the interviews were linked to a competence area of DigComp and rated on a 4-point ordinal scale.

Results: Based on the accounts from 10 participants, a total of 208 meaningful units, were identified. Of these 155 (74.5%) were coded, while 53 (25.5%) remained uncategorised. The competence area *Problem solving* accounted for 49% of the instances, *Communication and collaboration*, and *Data literacy* each accounted for 21%, *Safety* accounted for 8%, and *Digital content creation* for 3%. The overall proficiency level score was a mean of 1.99 (SD = 0.83), indicating an intermediate level of digital competence.

Conclusions: This study uncovered an uneven distribution of digital competence among physiotherapy students, highlighting the absence of several potentially clinically important competencies. Moreover, the students' overall proficiency level in digital competence was determined to be at an intermediate level. Deficiencies in their digital competence could have implications for critical clinical aspects, including integrating digital content in patient interactions and addressing safety concerns.

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Digital competence; physiotherapy education; DigComp; digital learning; health professions education; digital transformation

Introduction

Since 2006, the European Commission has emphasised digital competence as one of the eight key competencies for lifelong learning [1]. Digital competence encompasses the confident, critical, and responsible use and engagement with digital technologies for learning, work, and societal participation. Building upon this framework, the recent higher education digital education action plan for 2021–2027 highlights digital competence as one of its main strategic priorities [2]. Similarly, Norwegian strategies align with the efforts of the EU Commission and strongly advocate for the implementation of digital competence education across modules and study programs [2,3]. In the Norwegian context, the focus on digital competence is also driven by the demands of future workplaces, where digital competence among employees and organisations is considered essential for successful transformation processes [4].

Physiotherapy education, as one of the health professions study programs, encompasses various competence domains, including ethical and professional practice, communication, evidence-based practice, interprofessional teamwork, and leadership [5]. Considering the COVID-19 pandemic, the World Confederation for Physiotherapy released a report emphasising the significance of digital physiotherapy practice. The report highlighted the potential of modern technologies and digital practices to facilitate effective and impactful engagement with diverse audiences [6]. The task force responsible for the report recommended exploring specific technologies such as robotics, sensors, wearable devices, virtual reality, and artificial intelligence, as they hold great potential for physical therapists [6]. It is crucial for professionals to continually develop their knowledge and skills to stay updated with evolving practices, modes of practice, and technologies [6].

While digital practice in physiotherapy education carries implications across all levels, there is currently a lack of universally agreed-upon educational standards for digital practice [6]. Existing evidence indicates the wide range of digital technologies employed in physiotherapy education [7]. Furthermore, research supports the effectiveness of specific digital learning designs in physiotherapy education compared to traditional teaching methods [8]. However, despite the extensive use of digital educational technologies in physiotherapy education, there is limited evidence to suggest that they are effectively utilised to enhance students' digital knowledge, skills, and attitudes.

The European digital competence framework for citizens, recently updated to DigComp2.2, offers a comprehensive

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overview of the knowledge, skills, and attitudes encompassed by digital competence [9,10]. The framework's latest update includes five competence areas: *Information and data literacy*, *Communication and collaboration*, *Digital content creation*, *Safety* and *Problem solving* [9]. The development of the DigComp framework involved consultation with numerous stakeholders, including input from prominent international organisations such as ILO, UNESCO, UNICEF, and the World Bank [9]. This framework establishes a shared understanding of digital competence and can be utilised to identify professional digital profiles across different contexts, including education and employment [9].

A recent governmental report in Norway, analysing the future demands of health personnel in 2040, concluded that increased utilisation of technology in healthcare is crucial to meet growing demands [11]. Based on these projections, it was recommended that digital competence be fully integrated and operationalised in health professions education programs [11]. Within the Norwegian common regulations framework for health and social sciences education, one of the learning outcomes states that graduating students should possess digital competence and be capable of contributing to the development and utilisation of relevant technologies at both individual and systemic levels [12]. To accomplish this, it is essential to understand how students currently utilise and integrate technologies in their formal learning. Therefore, the aim of this study was to investigate the digital knowledge, skills, and attitudes of undergraduate physiotherapy students, using the European Digital Competence Framework as a reference.

There are various definitions of digital competence in the higher education literature; findings in a systematic review, however, show that most published studies since 2015 have referenced both research and EU policy to define the term [13]. Moreover, the suggests that students and staff possess only a basic level of digital competence. Consequently, the authors emphasised the need for higher education institutions to implement strategies to enhance digital competence [13]. Similar findings regarding an inadequate level of digital competence among university students, were made in another review from 2020 [2]. Despite that pedagogical use of technology is now more frequently included in higher education study programs and that students are proficient digital users, there is no support that this facilitates their digital competence [14,15]. Findings from three studies on health professions- and higher education students' digital competence areas, suggest that they are most confident within the competence areas *Information and digital literacy* and *Communication and collaboration,* while least confident in the area of *Digital content creation* [16–18].

Review findings on the use of technology in physiotherapy education show that a wide range of digital technologies were used, including quizzes, videos, social media, learning management systems, and content repositories [16]. Another systematic review on digital learning designs in physiotherapy education found significant positive effects on student learning for interventions utilising flipped classrooms, interactive websites/apps, and student-produced videos [8]. A qualitative study including teachers in physiotherapy education, revealed their scepticism towards digital education, viewing digital technology primarily as a tool to support established teaching practices [19]. Findings on the attitudes towards technology among physiotherapists in clinical settings are contrasting, ranging from acknowledging the potential for digitalisation in the physiotherapy sector to scepticism towards digital remote therapy [10,17,20].

This study

Current evidence suggests that there are shortcomings according to the breadth and depth of higher education students' digital competence. Particularly, this seems to be the case in digital competence areas such as content creation. At graduation, candidates in health professions education should have acquired the necessary digital knowledge, skills and attitudes required to meet current and future requirements for health personnel. Due to the widespread implementation of educational technology and the implications of the digital transformation for the physiotherapy profession, physiotherapy education constitutes an interesting case for investigations of digital competence among higher education students. To ensure that students possess the necessary breadth and depth of digital competence, the Digital Competence Framework from the EU Commission serves as a point of departure. The study aimed to address the following research questions:

1. How is the students' digital competence distributed within the areas of the DigComp framework.
2. What is the proficiency level of the students' digital competence?

Materials and methods

Focus group interviews

The study had a qualitative design with focus group interviews. The participants were second-year students enrolled in the physiotherapy study program at a Norwegian university for professional education. Altogether two focus group interviews, each with five participants were conducted on the same day by a researcher (YR), who had not participated in any education at the study program. Participation was based on informed consent, and the study was approved by the Norwegian Centre for Research Data (ref. 178211), 13 June 2022. The students had several weeks before the interviews took place, been informed about the study. The participants were selected from a convenience sample of volunteers. Written informed consent was obtained face-to-face, before the interviews were conducted. The data used in this study were anonymised prior to utilisation and all methods adhered to the principles outlined in the Declaration of Helsinki and complied with institutional regulations.

On participation, the students had finished a compulsory course on assessment and treatment of persistent pain disorders. The content of the course focused on traditional treatment modalities such as exercise treatment. For several years

the course had successfully used a blended learning model flipped classroom). Blended learning has been defined as the thoughtful integration of classroom face-to-face learning experiences with online learning experiences [21]. This entailed that the digital learning material (video lectures, online resources, podcasts etc.) had been made available beforehand, and that all in-person learning was used for collaborative working in groups. In design of the learning activities higher levels of learning (e.g. critical and reflective thinking), had been a priority [21,22]. Previous experiences from this digital approach are described in detail, elsewhere [23].

A semi-structured interview guide was used for the interviews. The interview guide consisted of two parts; the first part focused on the students' recent and specific digital learning experiences during the course and previously in the physiotherapy program, including how they collaborated as a group, solved problems and utilised the digital material. In the second part of the interview the students were encouraged to reflect on general issues related to the implementation of technology in the study program, their digital learning practices in general and whether they had any ethical concerns regarding the use of technology. The topics in the second part of the interviews was informed by a proposed model for digital competence at school, proposed by Calvani et.al [24]. The model comprises four dimensions: Technological, ethical, cognitive and the integration between the three dimensions [24]. The complete interview guide is available as a supplementary file (Supplementary file 1).

Analysis

Table 1 presents the competence areas and competences of the DigComp 2.2 framework. The recent update of the framework includes five competence areas: *Information and data literacy*, *Communication and collaboration*, *Digital content creation*, *Safety*, and *Problem solving* [9]. Prior to conducting the analyses, the focus group interviews were transcribed verbatim and combined.

Table 1. DigComp 2.2 competence areas and competences.

Competence area	Competence
Information and Data Literacy	Browsing, searching and filtering data, information and digital content
	Evaluating data, information and digital content
	Managing data, information and digital content
Communication and Collaboration	Interacting through digital technologies
	Sharing through digital technologies
	Engaging citizenship through digital technologies
	Collaborating through digital technologies
	Netiquette
	Managing digital identity
Digital Content Creation	Developing digital content
	Integrating and re-elaborating digital content
	Copyright and licences
	Programming
Safety	Protecting devices
	Protecting personal data and privacy
	Protecting health and well-being
	Protecting the environment
Problem Solving	Solving technical problems
	Identifying needs and technological responses
	Creatively using digital technology
	Identifying digital competence gaps

Note. Retreived from the European Commission Joint Research Centre, Vuorikari, et al (2022). Retrieved from https://publications.jrc.ec.europa.eu/repository/handle/JRC128415.

Two researchers, YR and GCR carried out the analysis. YR had long experiences with pedagogical use of technology in physiotherapy education and was also familiar with the DigComp framework. GCR had a background as a clinical physiotherapist and had several years of experience working as a teacher in physiotherapy education, including administrative responsibilities.

The analysis was carried out as a two-step process: The first step encompassed the classification of the students' digital competence to the DigComp framework, based on the transcribed interviews. The point of departure was to generate a meaningful unit, representing a shared meaning, from a students' account. In some cases, a meaningful unit was derived from a single sentence, in other cases from several consecutive sentences. As an example, a student raised the following claim: "Very true, but I also miss the interaction with the lecturers, being able to ask questions like you mentioned in physical lectures. We could probably use more of that." From this, we decided that the actual meaning (meaningful unit) was "longing for more interaction with lecturers", which was linked to the competence "Identifying digital competence gaps" in the competence area *Problem solving*. This procedure was repeated for all the students' accounts. Meaningful units which we judged not be covered by any competence, were labelled uncategorised.

In the second step, the proficiency level of the classified meaningful units was scored using the 4-point ordinal scale of the DigComp framework, with the following anchors [9]: Foundation (1), intermediate (2), advanced (3), and highly specialised (4).

The coding and scoring of proficiency level was carried out as a collaborative process between the researchers, aimed to improve the quality of the analyses. After familiarising with the DigComp framework, the researchers conducted the analysis from a small sample, independently. Thereafter, they met and discussed the variations in their results, difficult cases and made the final decisions. Thereafter, booth researchers performed the rest of the analysis and repeated the above-mentioned procedure until a final decision was made.

Descriptive statistics, including frequencies, mean and standard deviation, were used to report the number of instances and the magnitude of the proficiency level scores [25]. The descriptive statistical analysis was carried out using SPSS version 27 software.

Results

Altogether 10 informants who were students in physiotherapy participated in two focus group interviews. Of these participants, six were female and four males.

In total, 208 meaningful units, representing student accounts, were analysed, with 96 from the first focus group

and 112 from the second group. Among these accounts, 155 (74.5%) were categorised into one of the competence areas defined by the DigComp 2.2 framework, while 53 (25.5%) remained uncategorised. A majority of the uncategorised instances contained complaints about technological infrastructure issues, such as a lack of power supplies and charging stations, as well as a scarcity of informal areas for digital collaboration on campus.

The distribution between competence areas is illustrated by the pie chart in Figure 1. The by far most frequent competence area, *Problem solving*, accounts for almost half (49%), whilst the two lowest frequent, *Safety* and *Digital content creation* for only 8% and 3% of the classifications, respectively.

According to the more detailed, linked DigComp, competences (shown in Table 1) there were some findings worth noting: Within the high frequent competence area *Problem solving,* all competences, with the exception of Creatively using digital technology, were represented. Next, within *Information and data literacy* all competences were represented. Within *Communication and collaboration*, all competences with the exception of Engaging citizenship through digital technologies, were represented.

Within the low frequent *Safety* competence area, all units were linked to Protecting personal data and privacy, while Protecting devices, - health and well-being, and – the environment were not represented. In the lowest ranked area *Digital content creation*, all units were linked to Developing digital content, while Integrating and re-elaborating digital content and Copyright and licences, were absent in the material.

Extent of the students' digital competence

The Mean proficiency level scores are shown in Table 2. The overall proficiency level score was mean 1.99 (SD = 0.83), reflecting the intermediate level of digital competence.

The distribution of proficiency level scores is displayed in Figure 2. As shown by the histogram, the distribution was clearly skewed to the left, indicating a non-normal distribution.

The distribution of proficiency level scores for each competence area is presented in Figure 3. As previously mentioned, *Problem solving* emerged as the most frequently mentioned competence area overall. However, when examining the proficiency level scores, it becomes evident that the frequency of highly specialised and advanced levels was generally low across all competence areas, with no instances of such levels reported in the *Digital content creation* area.

Discussion

The main findings of this study indicate that certain competence areas may be underrepresented, and that the overall extent of the digital competence of physiotherapy students is at an intermediate level. A significant finding is that the competence areas of *Digital content creation* and *Safety* accounted for only 3% and 8% of the instances, respectively. It is noteworthy that out of the eight competencies within these areas (Table 1), only two were represented. These missing competencies encompass potentially important knowledge and skills for their future endeavours in implementing digital technologies in their roles as health professionals. For instance, in scenarios like remote physiotherapy services, the ability to provide patients with digital materials for supervision and education is crucial. Despite the COVID-19 pandemic prompting many physiotherapists to adopt video consultations and other technologies for remote patient monitoring, post-pandemic surveys have revealed mixed opinions among physiotherapists regarding the use of technology [17,20,26]. However, the infrequent engagement in *Digital content creation* observed in this study aligns with findings from three other studies conducted among higher education students in different disciplines [4,27,28].

While future concepts for integrating technology into physiotherapy and physiotherapy education are still evolving, the World Confederation of Physiotherapy advocates for

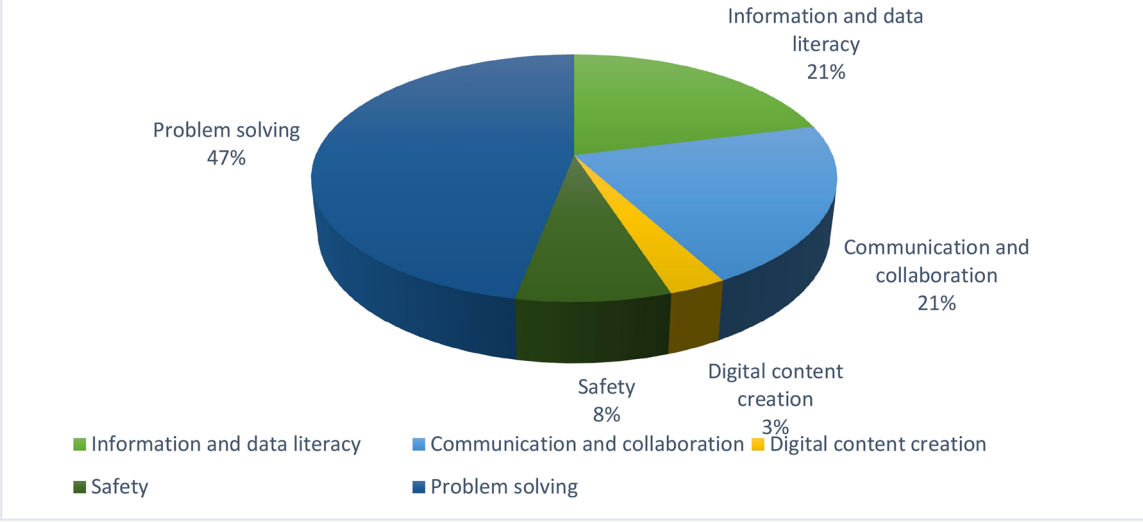

Figure 1. Distribution of student accounts ($n = 155$), across competence areas.

Table 2. Mean proficiency level scores (SD) for each competence area, individually.

Overall proficiency level scores	1.99 (SD = 0.83)
Information and Data Literacy	1.94 (SD = 0.93)
Communication and Collaboration	2.19 (SD = 0.97)
Digital Content Creation	1.60 (SD = 0.55).
Safety	2.69 (SD = 0.48)
Problem Solving	1.84 (SD = 0.70)

considering specific technologies in future physiotherapy practice. These technologies encompass robotics, sensors, wearable devices, virtual reality, and artificial intelligence [6]. Apart from identifying crucial technologies, the physiotherapy community must define the professional skills necessary to employ these technologies efficiently, safely, and responsibly. Equipping candidates with these skills is essential for physiotherapy education to meet both present and future demands in the field. The ongoing debate about this implementation has predominantly centred on its potential to enhance students' existing learning outcomes, rather than addressing the transformative implications of the technology for physiotherapy education [29]. Various digital technologies have already been tested and implemented in physiotherapy education, yielding promising results in multiple settings [8,16]. In anticipation of research or guidelines on the future digital skills required in physiotherapy and physiotherapy education, we believe that the generic DigComp provides a useful starting point.

A considerable proportion (25.5%) of the student accounts examined in this study were uncategorised, indicating that they could not be attributed to any specific competence area within the DigComp framework. In most instances, these accounts referred to physical digital barriers, such as a lack of power supplies. This finding suggests that the general DigComp framework for citizens may not fully encompass all the critical aspects of the students' digital learning experiences. The students' concerns in this area closely align with a review on barriers to the implementation of active digital learning, which highlighted factors such as architecture, spatial design, furniture, and their arrangement that hindered students' visibility or created physical separation between teachers and students [30]. Based on these findings, we propose the necessity for a framework specifically tailored to address students' digital learning experiences.

Our findings revealed an intermediate proficiency level, slightly higher than a previous review that reported students and staff generally possessing only basic digital competence [31]. However, considering the increasing digital demands placed on physiotherapists and other healthcare professionals in future healthcare, we argue for the necessity of aiming for even higher proficiency level scores. There is also evidence to support that there is a discrepancy between students' digital competence acquired through informal learning and its practical application in formal learning [14,15]. We assert that significant improvements in students' digital competence will require the development of targeted educational approaches, as recommended in the literature and governmental strategies [2,3,31]. We also advocate that these educational approaches be closely linked to the specific clinical tasks relevant to the students' role as healthcare personnel.

Study limitations

This study had several limitations that should be taken into account. According to the European Commission, the DigComp framework applies for all citizens in a lifelong learning perspective. Due to its generic characteristics, it might not capture the specific needs of physiotherapy students learning in the study program, nor in clinical practice. Since the introduction of the DigComp framework, the European Commission has launched digital frameworks that cover specific situations. An example of this is the DigCompEdu framework, which covers educators' digital competence [32]. Despite the lack of a similar framework for students' digital

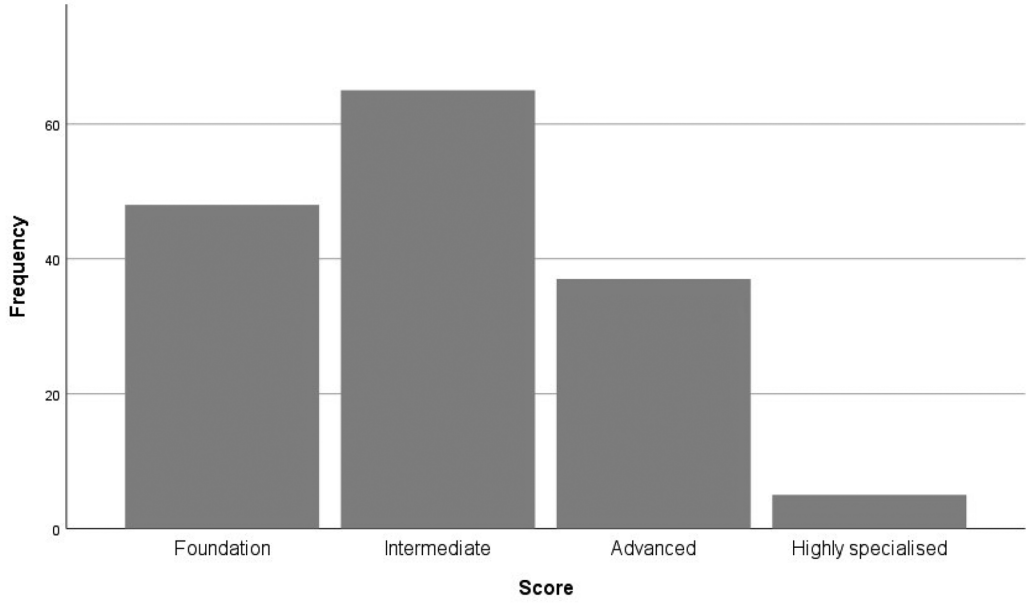

Figure 2. Histogram displaying the distribution of proficiency level scores.

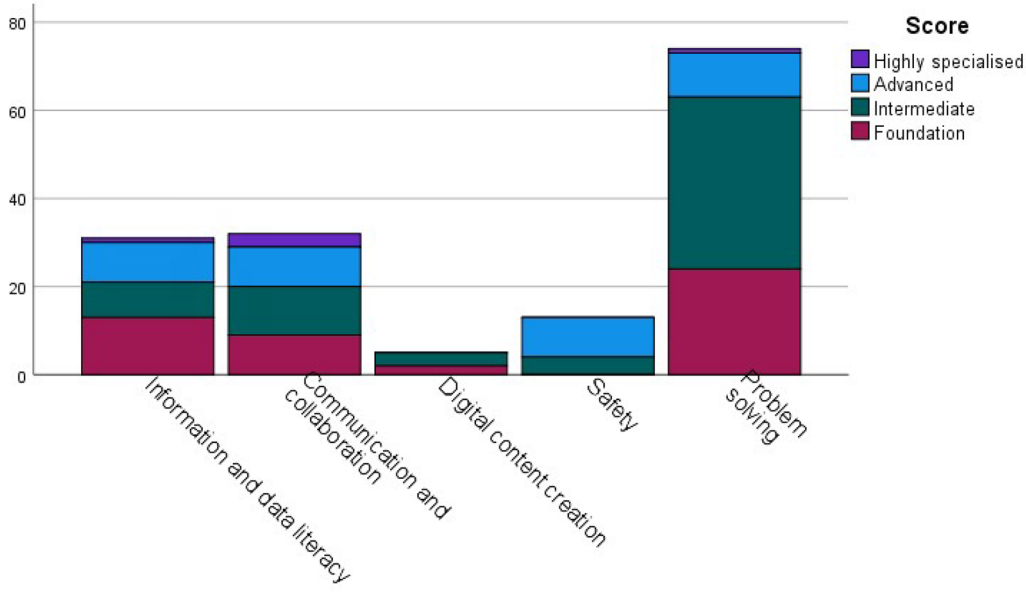

Figure 3. Distribution of proficiency level scores for each competence area, individually.

competence and uncertainties regarding the future digital competence of physiotherapists, we still think the DigComp framework provides a point of departure for identifying the digital learning needs of physiotherapy students. Next, we are not aware of any other work which has linked information from qualitative interviews with the DigComp framework. Nonetheless, similar methods for connecting content to frameworks are available in other domains, such as linking content to the International Classification of Functioning, Disability, and Health framework [33]. Lastly, the interpretation of the findings can be subject to debate. The fact that students did not mention certain competencies can, but should not necessarily, be interpreted as a gap in their knowledge base. Nevertheless, we believe that due to the structured interview approach and the follow-up questions by the interviewer, the areas discussed by the students during the interviews provide a comprehensive picture of their digital learning practice, thus a valid representation of their digital competence.

Conclusions

This study uncovered an uneven distribution of digital competence among physiotherapy students, highlighting the absence of several potentially clinically important competencies. Moreover, the students' overall proficiency level in digital competence was determined to be at an intermediate level. Deficiencies in their digital competence could have implications for critical clinical aspects, including integrating digital content in patient interactions and addressing safety concerns. These findings emphasise the need for educational institutions to enhance their strategies for developing digital competence. Further research is essential to determine whether these findings are consistent across other undergraduate programs in health professions education.

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