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Empowering digital competence through peer-assisted learning and virtual reality in health professions education

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This study examines the integration of peer-assisted learning (PAL) and virtual reality (VR) gaming in health professions education, focusing on an occupational therapy program in Norway. While PAL is known to enhance clinical skills and knowledge, its role in fostering digital competence has been less explored. This research addresses the gap by investigating how peer assistants perceive their roles and development while integrating VR into health education. Implemented since 2021, the educational approach positions peer assistants as supervisors of VR gaming activities, independent of faculty involvement. Following a rigorous recruitment and training process, a “train-the-trainer” model fosters autonomy, leadership, and collaboration, guided by sociocultural learning theory. Three focus groups with 10 peer assistants revealed evolving teacher identities, technological mindsets, and professional growth. Assistants leveraged their unconventional gaming and technology backgrounds to connect digital tools with healthcare practices, emphasizing the role of reflection in leadership development and career aspirations. The findings highlight the dual impact of PAL and VR in advancing students’ digital competence while empowering peer assistants through professional transformation. Challenges, such as technological hesitancy and gender dynamics, were addressed with inclusive strategies. This study contributes to understanding the integration of digital technologies in health professions education, offering a replicable model to foster digital competence and prepare healthcare professionals for a digitalized landscape. Future research should investigate scalability across disciplines and institutions.

KEYWORDS

peer-assisted learning, digital competence, virtual reality, train-the-trainer, technology

Introduction

Peer-Assisted Learning (PAL) is an educational strategy which pertains certain benefits to all stakeholders, i.e., universities, the peer-teacher, and the peer-learner (Topping and Ehly, 1998). A unified terminology for PAL has been suggested, based on the type of relationship and contact ratio between the peer teachers and -learners (Olaussen et al., 2016). Studies focusing on the effectiveness of PAL for students’ learning, has reported promising findings: A review from medical education, found that there is evidence to suggest that peer-assisted learning leads to improvements in clinical knowledge and skills learning, compared with traditional teacher-led passive learning (Zhang and Maconochie, 2022). Similarly, another review concluded that medical students experiencing PAL benefit in terms of academic

performance, relative to those not receiving PAL, particularly in the clinical stages of training and for practical skills (Brierley et al., 2022). Until now, there has been little research on the use of PAL in relation to technology integration in health professions education.

There is an urgent need in health professions education to develop strategies that enhance digital competence to meet both current and future demands. The European Commission promotes digital competence as a vital skill for all educators and training personnel, to be weaved into every facet of their professional development (Digital Education Action Plan, 2021). Digital competence is defined as the confident, critical, and responsible use and engagement with digital technologies for learning, work, and societal participation (European Commission: Directorate-General for Education, Youth, Sport and Culture, Key competences for lifelong learning, Publications Office, 2019). In the Norwegian digital action plan for higher education and research (2021–2025), implementation of digital competence as a theme, across disciplines and courses, is strongly recommended (Actionplan for the Digital Transformation of Higher Education and Research, 2022). Also, in the Norwegian common regulation for health- and social education, digital competence and innovation capacities are explicitly mentioned as learning outcomes for candidates on graduation (Ministry of Education and Research, 2017). However, despite these strategic directives, a clear and cohesive framework for developing work-relevant digital competence tailored to the specific needs of healthcare professionals has yet to be fully realized.

Digital technologies are expected to interfere in key areas such as diagnosing, guide treatment decisions, increase person-centered care as well as creating more evidence-based knowledge to support professionals (World Health Organization, 2021). Norway has a mainly publicly funded healthcare sector, which strategic aims are to implement digital solutions that promote comprehensive collaboration among healthcare professionals and enhance opportunities for patients, users, and the general public to actively participate in managing their own health (Meld. St. 9, 2024). To support the digital transformation of healthcare, the government is indicating a commitment to strengthening the national digital infrastructure and governance systems (Meld. St. 9, 2024). The Norwegian Directorate for e-Health has identified three overarching goals for the digital transformation of the health and welfare sectors: quality and continuity of services, a sustainable health and care system, and increased innovation capacity (Nasjonal e-helsestrategi, 2023). Moreover, the Directorate underscores that digital competence is a critical prerequisite for achieving these objectives (Nasjonal e-helsestrategi, 2023).

Health technologies encompass a variety of tools, among which virtual reality (VR) stands out as an innovative technology. VR is a high-end user–computer interface that enables real-time simulation and interaction through visual and auditory sensory channels (Mazurek et al., 2019; Rutkowski et al., 2020). In recent years, VR has gained popularity as a teaching and learning support tool, particularly in healthcare and technology education (Oyelere et al., 2020). It allows students and teachers to experience and interact with real-time learning scenarios that would otherwise be difficult to replicate (Oyelere et al., 2020). Preparing students to be active participants has been identified as a key strategy for the successful future implementation of VR in simulation-based, interprofessional education (Liaw et al., 2022). Additionally, VR gaming is increasingly being used in specialized rehabilitation for neurological conditions, such as stroke, and for recovery following musculoskeletal injuries

(Ong et al., 2021; Shahmoradi et al., 2021; Gustavsson et al., 2022; Gouveia et al., 2023). Given its various applications in healthcare, VR technology is highly relevant for integration into health professions education.

Until now, health professions education has lacked comprehensive strategies for integrating technology into learning in ways that effectively enhance students' overall digital competence. Findings from a systematic review on digital competence among higher education students concluded that a majority of students do not acquire an adequate level of digital competence and that staff and teachers should adapt their training to the pace of technological evolution (Sánchez-Caballé et al., 2020). In extension of this, another review found that most university students and teachers have a basic level of digital competence (Zhao et al., 2021). A study from physiotherapy health professions education found that despite considerable integration of digital technologies in the syllabus, students' digital competence remained at an intermediate level, with potential impacts for clinical aspects such as integrating digital content in patient interactions and addressing safety concerns (Røe et al., 2023). A similar study focusing on physiotherapy educators digital pedagogical conceptions, found that they were sceptical about digital education, primarily viewing it as a threat to established teaching practices (Ødegaard et al., 2022). Thus, there is a need to increase digital competency in healthcare students and decrease possible scepticism within teacher groups.

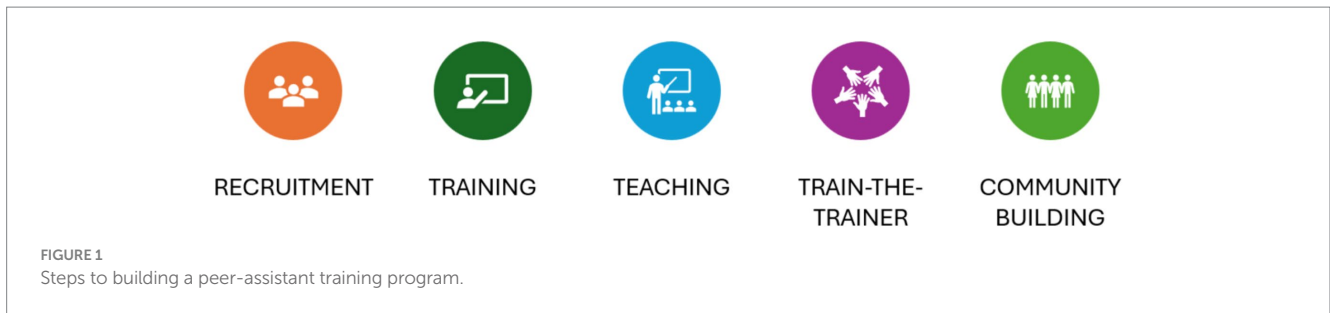
Train—the—trainer model

The educational approach for the VR gaming course was developed by two of the course leaders (EBB and TSJ) for second year occupational therapy students at a Norwegian university. Since its implementation in 2021, the course has largely relied on peer assistants, who have undergone a targeted and progressive pedagogical training process, to teach and supervise students without direct involvement from the academic staff. This model, which follows a structured progression (illustrated in Figure 1), is rooted in sociocultural learning theory, emphasizing interaction as central to effective learning (Vygotsky, 1978). The peer-assistant program was designed to foster autonomy by positioning the teacher as a facilitator of student-driven learning.

The process begins with recruitment, where peer assistants are selected through a rigorous application process. Students from the occupational therapy program are invited to apply. Candidates submit a written application with a motivational letter, undergo interviews, and are ranked to identify the most qualified applicants, who are then offered employment contracts.

Following recruitment, assistants participate in an introductory training course, during which they are supervised by course leaders. Over a three-month period, they learn to analyze new technology, adapt it for rehabilitation, and gain proficiency in using VR and gaming tools. Training includes two hours of weekly mentorship, self-directed learning, and reading research literature. During this phase, assistants also develop procedures for teaching fellow students how to use the technology effectively.

In the teaching phase, trained peer assistants supervise student groups working on fictional clinical cases, guiding them in skill development and technology use through role-playing and collaborative exercises. Their supervision responsibilities include facilitating case discussions and leading skills training sessions.



As the program evolves, experienced peer assistants transition to the train-the-trainer phase, where they take full responsibility for training new assistants. This approach, emphasizing active and metacognitive learning, removes direct involvement from course leaders and empowers the peer assistants to develop leadership and instructional skills (Bonwell and Eison, 1991).

Finally, the program fosters community building by establishing a network of experienced peer assistants who contribute to the continuous improvement of the course. They take part in evaluating and refining teaching plans, enhancing both the academic quality and the learning environment. By June, 2024, three cohorts of peer assistants will have completed this training process, ensuring sustainability and long-term impact.

Knowledge gaps, aim and research questions

Empirical findings indicate that health professions education programs continue to face challenges in creating work-relevant digital learning environments. A lack of digital interest and competence among regular teaching staff may act as a barrier to fostering students' digital competence. Promoting digitally proficient students as peer educators through peer-assisted learning (PAL) could be a strategy to address these limitations.

This paper explores an innovative educational approach within occupational therapy education, utilizing PAL in VR gaming. The approach has been integrated into the program's syllabus and undergone multiple iterations, with a significant number of peer assistants participating. Rather than focusing on student learning outcomes, this study aims to examine the peer assistants' role awareness, professional development, and their perceived contributions to integrating health technology into the curriculum.

The aim of this study was to explore peer assistants' experiences of teaching VR gaming in occupational therapy and their perceptions of how their role contributes to fostering a broader technological mindset in health professions education. Specifically, the study sought to address the following research questions:

Primary research question:

How does the integration of Virtual Reality and Peer-Assisted Learning contribute to developing digital competence and fostering a technological mindset in health professions education?

Secondary research questions:

How do peer assistants perceive their roles and professional development through participation in VR-based Peer-Assisted Learning?

What are the challenges and enablers in implementing VR and PAL in fostering digital competence and inclusivity among students?

How does the "train-the-trainer" model impact leadership and learning autonomy for peer assistants?

The findings of this study aim to provide insights into how health professions education can design effective educational strategies to prepare healthcare professionals to meet the growing demands for digital competence.

Materials and methods

Study design

This qualitative study conducted focus group interviews with students who served as teachers in a peer-assisted learning approach utilizing Virtual Reality Gaming within a health education study program at a Norwegian university. The study followed the COREQ (COnsolidated CRiteria for REporting Qualitative research) Checklist (Tong et al., 2007) (Supplementary file 1).

Recruitment and interviewing

Three focus groups, comprising a total of 10 participants (six male and four female), were conducted to gather insights from student assistants with varying levels of experience. The first group included students who had completed the full educational approach, the second group consisted of those in the middle of the process, and the third group comprised students who had recently completed their preparatory training. The interviews took place between October 10, 2023, and February 6, 2024.

Two interviews were conducted digitally via Zoom, while one was held in person. All interviews were recorded and transcribed using Microsoft Office 365, which effectively distinguished between speakers but had limitations in capturing Norwegian linguistic nuances, such as slang and dialects. To ensure accuracy, the transcriptions underwent detailed language editing by one of the authors (Y.R.), improving clarity and consistency in the data.

Analysis

The data were analyzed using a reflexive thematic approach, following the six-step process outlined by Braun and Clarke (2019, 2021): (1) familiarizing with the data and writing familiarization notes, (2) systematically coding the data, (3) generating initial themes from the coded and collated data, (4) developing and reviewing themes, (5) refining, defining, and naming themes, and (6) producing the final report. Themes were conceptualized as “patterns of shared meaning, cohering around a central concept” (Braun and Clarke, 2021), providing a framework for organizing the data into meaningful insights. To enhance readability and structure, themes were further refined into sub-themes (Braun and Clarke, 2021).

A deductive reflexive thematic analysis was employed, using the conceptual framework of digital competence as a guiding lens to interpret the data. This deductive approach ensured the analysis was anchored in the study’s research focus while remaining flexible to emergent patterns. A latent coding approach was adopted, emphasizing the identification of implicit and underlying meanings within the data (Braun and Clarke, 2021). This allowed for a nuanced exploration of participants’ experiences and the contextual factors influencing digital competence development.

To ensure rigor and consistency, the authors contributed to the analysis process at different stages. The initial coding and theme development were primarily conducted by one author, with regular consultations and discussions among the team to review progress and provide feedback. This iterative process allowed for refining interpretations and ensuring alignment with the study’s aims. While the final themes were agreed upon collectively, the primary analytical work was driven by one author, with input from the others to incorporate diverse perspectives and enhance the robustness of the findings.

Ethics

Ethical approval for the study was obtained from the Norwegian Agency for Shared Services in Education and Research (Sikt) under reference number 620228, dated September 27, 2023. The study was conducted in compliance with institutional research regulations.

Results

Based on the thematic analysis of the interviews, the themes and sub-themes developed, are displayed in the below table and further elaborated with citations in the text (Table 1).

Evolving peer-assisted teacher identity

Motivation and commitment

Peer assistants highlighted how their unconventional backgrounds, particularly in gaming and technology, motivated them to engage with VR in healthcare education. Their personal interests

TABLE 1 Themes and sub-themes developed from the thematic reflective analysis.

Main overarching themes	Sub-themes
Evolving peer-assisted teacher identity	Motivation and commitment Navigating uncertainty and building autonomy Adapting teaching responsibilities and fostering peer relationships
Fostering a technological mindset in health education	Addressing technological hesitancy and varied digital competence Promoting innovation and VR in healthcare Recognizing the importance of inclusivity in tech adoption
Professional development and personal transformation	Building a network for future careers Reflection and leadership development Inspiring deeper academic and technological engagement

aligned with the opportunity to apply these skills in a professional and academic setting.

PA4: “I’ve played a lot since I was young, so when I heard about this VR rehabilitation project, I immediately wanted to join.”

PA5: “I’m into technology, games, and VR... this seemed like great experience, especially for occupational therapy with VR.”

The intrinsic motivation to explore innovative approaches to healthcare education was further strengthened by the uniqueness of the opportunity. Peer assistants often invested significant time outside of their coursework, seeing it as an invaluable experience.

PA5 remarked: “We stayed after class for 2–3 h. Others had left, but we were gaining something valuable—an opportunity others did not have.”

This sense of commitment drove them to embrace the role fully and develop new expertise.

Navigating uncertainty and building autonomy

While initially uncertain about their responsibilities, comprehensive pedagogical training provided the confidence and framework needed to explore their teaching styles and take ownership of their roles.

PA2 explained: “We received strong follow-up and a flexible framework. We felt confident in our learning, with time to explore independently.”

Over time, this structure empowered assistants to develop autonomy, helping them transform into confident educators who contributed meaningfully to their peers’ learning experiences.

Adapting teaching responsibilities and fostering peer relationships

Balancing their dual roles as peers and teachers posed challenges. Peer assistants navigated the delicate balance between authority and camaraderie, adjusting their approach as needed.

PA7 reflected: “I felt myself switching roles, especially when explaining equipment... and then stepping back as they practiced on their own.”

This ability to shift between guiding and supporting fostered adaptability and strengthened their teaching identity.

Fostering a technological mindset in health education

Addressing technological hesitancy and varied digital competence

Peer assistants observed differences in technological comfort levels among students and healthcare professionals. They noted resistance from older generations but expressed optimism about the younger generation's adaptability.

PA1 shared: "There's concern that technology could diminish interpersonal connections... but younger healthcare professionals may have a more positive attitude toward technology."

Tailoring their teaching to students varied technological backgrounds helped make technology more accessible and fostered a supportive learning environment.

PA1 stated: "We had to teach technological solutions to people with different tech backgrounds, adapting our approach to each student's comfort level."

Promoting innovation and VR in healthcare

Peer assistants emphasized the potential of VR in rehabilitation, particularly for patients with specific challenges like social anxiety.

PA5 observed: "VR offers another way for people with social anxiety to engage, especially if they struggle with in-person interactions."

These insights highlighted how VR and other digital tools could democratize access to healthcare and improve patient engagement.

Recognizing the importance of inclusivity in tech adoption

The assistants also acknowledged the importance of fostering an inclusive environment for students, particularly addressing gender dynamics in technology.

PA2 noted: "In gaming, there's still a stigma around girls, who often face harassment. This can make some hesitant to show their interest in tech."

Creating inclusive spaces ensures diverse perspectives are represented in healthcare's digital transformation.

Professional development and personal transformation

Building a network for future careers

Participation in the program provided assistants with valuable professional connections and a competitive edge in their career paths.

PA9 explained: "This experience shows commitment on my CV, especially mentoring in a varied learning environment with different student motivations."

This professional networking opportunity extended beyond VR and gaming, preparing them for broader healthcare roles.

Reflection and leadership development

Through reflective practices, assistants recognized significant personal and professional growth. Many described how the project helped them embrace leadership roles they had not envisioned for themselves.

PA4 shared: "Leading something and making it work has changed me, giving me confidence in myself and my role as an occupational therapist."

Inspiring deeper academic and technological engagement

The program also inspired assistants to pursue academic and professional interests in technology, aligning these with their long-term goals.

PA7 reflected: "I think it's exciting, something I'd like to work with further, even write my bachelor's thesis on it as part of occupational therapy."

This broadened their understanding of how technology intersects with healthcare and motivated them to explore its potential further.

Final summary

Through evolving teacher identities, fostering a technological mindset, and undergoing transformative personal growth, the peer assistants played a pivotal role in shaping a forward-looking, tech-integrated approach to health education. Their reflections highlight the potential of peer-assisted learning and digital tools in preparing future healthcare professionals for the challenges of a rapidly evolving field.

Discussion

The integration of peer-assisted learning (PAL) with virtual reality (VR) in health professions education represents a progressive pedagogical strategy. This study highlights how VR-enhanced PAL fosters both technological curiosity and the development of critical skills among peer assistants, including leadership, self-confidence, and adaptability. These findings emphasize the dual benefits of technology integration: advancing digital competence among health professions students and supporting professional identity formation among peer assistants (Car et al., 2022).

The research on the use of PAL to integrate technology in health professions education is, however, limited. A study from medical education found, based on survey data, that the use of peer-led teaching with VR scenarios increases medical student engagement in learning and confidence in dealing with post-surgical complications (Panzures et al., 2024). While previous studies have recognized the role of PAL in enhancing clinical skills and engagement, our research adds a novel dimension by exploring the transformative experiences of peer assistants in a VR-focused context (Liaw et al., 2022). The peer assistants' narratives reveal a journey of personal and professional growth, often facilitated by their unconventional backgrounds in gaming and technology. This aligns with literature advocating for diverse skill sets in healthcare education to meet the demands of an increasingly digitalized healthcare system. A unique aspect of our approach lies in the comprehensive and highly structured steps to competence building in the peer-assistant program (see Figure 1). The emphasis on pedagogical training and the subsequent "train-the-trainer" model not only empowered peer assistants but also cultivated a sense of community and professional identity. This layered approach to

training, involving iterative cycles of teaching and mentoring, aligns with Vygotsky's sociocultural theory (Vygotsky, 1978) and active learning principles (Bonwell and Eison, 1991).

The peer assistants' reflections underscore the potential for VR-based learning environments to stimulate meaningful discussions about the role of technology in healthcare. For instance, the dialogs surrounding technological hesitancy illustrate how peer-led sessions can challenge traditional attitudes while promoting a balanced view of technology's potential and limitations. Such discussions are crucial for fostering a critical yet open mindset toward digital tools in healthcare, as highlighted in national and international digital health strategies (Longhini et al., 2022).

However, the findings also highlight challenges and limitations. While peer assistants played a pivotal role in fostering a technological mindset among students, achieving sustained digital competence requires more systematic institutional efforts within health professions education. This includes embedding digital health concepts across curricula in ways that align technological skills with ethical considerations, patient safety, and equitable access to care in diverse healthcare settings. Importantly, educators' attitudes toward digitalization must also evolve to facilitate this integration. Evidence suggests that some educators remain sceptical, often perceiving digital tools as a threat to traditional pedagogical methods (Ødegaard et al., 2022). Addressing this scepticism requires targeted professional development initiatives that focus not only on digital tools but also on their pedagogical value and relevance to clinical practice. Supporting educators in viewing digitalization as an opportunity for innovation, rather than disruption, could enhance their confidence and willingness to adapt (Zhao et al., 2021). Furthermore, fostering a culture of shared digital learning, where educators and students co-develop technological competencies, could mitigate resistance and promote collaborative, future-oriented teaching practices. Such approaches are essential to ensure responsible, patient-centred, and ethically sound technology implementation in healthcare education and practice.

A particularly compelling aspect of this study is the role of the peer assistants' unconventional backgrounds in shaping their contributions and development. Many assistants brought with them experience from gaming and technology communities, which not only sparked their interest in VR but also positioned them uniquely to bridge personal interests with professional roles. This alignment allowed them to approach VR-based health education with an enthusiasm and curiosity that extended beyond traditional pedagogical frameworks.

These unconventional backgrounds proved advantageous in multiple ways. First, they enabled the assistants to connect with students on a relatable level, often leveraging their gaming expertise to demystify technology and reduce apprehension among peers. Second, their familiarity with gaming culture and VR technology allowed them to adapt quickly to the technical aspects of the educational approach, enabling them to lead confidently and inspire curiosity among students. For some assistants, this experience marked the first time their gaming and technological skills were formally recognized and valued in an academic or professional setting, a transformative moment that fuelled their commitment to the program and fostered a sense of professional identity. The integration of such diverse skill sets also underscores the broader importance of expanding recruitment criteria in health professions

education. By embracing candidates with non-traditional backgrounds, programs can foster innovative approaches to teaching and learning, particularly in the integration of emerging technologies. The success of the peer assistants in this study suggests that unconventional expertise, such as that cultivated through gaming, can enrich health professions education by introducing alternative perspectives (Jimenez et al., 2020).

The integration of VR-based PAL in health professions education offers a unique opportunity to address the persistent gap in digital competence among both students and faculty. Prior studies have highlighted that many students graduate with only intermediate levels of digital competence, despite increasing reliance on digital tools in healthcare (Sánchez-Caballé et al., 2020). This study suggests that embedding digital technologies into peer-led learning environments can stimulate curiosity and foster a more nuanced understanding of technology's role in healthcare.

While this study primarily focuses on peer assistants, the indirect benefits to the students they taught are equally noteworthy. The VR-based, hands-on approach appears to create a non-hierarchical and supportive environment, encouraging students to engage with technologies they might otherwise find intimidating. Peer assistants reported observing shifts in students' attitudes, with many becoming more open to experimenting with digital tools. This highlights the potential of PAL to democratize access to digital competence, particularly in settings where students' technological backgrounds vary significantly (Aljahany et al., 2021). Future research could build on this by investigating how such peer-led, technology-rich environments influence students' digital skill development, professional confidence, and readiness to navigate increasingly digitalized healthcare systems.

Our study is not without limitations. The relatively small sample size and the focus on a single program restrict the generalizability of the findings. However, the longitudinal design and inclusion of assistants across multiple iterations strengthen the validity of our observations. Future research could expand on this by including peer assistants from different disciplines and programs to explore the scalability of this approach (Rutkowski et al., 2020).

Conclusion

In conclusion, this study underscores the transformative potential of combining peer-assisted learning (PAL) with virtual reality (VR) in health professions education. By leveraging the unique skills and perspectives of peer assistants, particularly those with unconventional backgrounds in gaming and technology, this approach has demonstrated its capacity to foster digital competence, inspire a technological mindset, and support professional identity formation. The structured recruitment and training of peer assistants, coupled with a "train-the-trainer" model, not only enhanced their leadership and teaching autonomy but also created a ripple effect of technological curiosity and engagement among students.

This study highlights the broader implications for health professions education in a rapidly digitalizing healthcare landscape. As digital technologies become integral to patient care, education must evolve to integrate these tools meaningfully, preparing students for both current demands and future innovations. While

peer-led approaches can nurture interest and adaptability, the responsibility of fostering comprehensive digital competence must also extend to curriculum design, faculty development, and institutional strategies. Collaborative efforts across disciplines and professions are necessary to build digital ecosystems that are inclusive, equitable, and aligned with the ethical and practical challenges of digital health.

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 the Norwegian Agency for Shared Services in Education and Research (Sikt). 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.

Author contributions

YR: Writing – original draft, Writing – review & editing. TSJ: Validation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. EBB: Validation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that Generative AI was used in the creation of this manuscript. This manuscript was developed with the assistance of generative AI tools (OpenAI's ChatGPT4o) for language editing, enhancing readability, and improving academic tone. Additionally, AI tools were employed in the transcription of interviews to facilitate data processing. All AI-assisted tasks were conducted under the direct guidance of the authors, who critically reviewed and refined the outputs to ensure accuracy and alignment with the research objectives. The intellectual content, analysis, and conclusions remain the sole responsibility of the authors.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2025.1550396/full#supplementary-material>

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