World Physiotherapy
Europe region

Briefing Paper –
Digital and Innovative Methods in Physiotherapy Education

Education and Research Working Group (E&RWG)

APPROVED

14th & 15th May 2026

Pristina, Kosovo

CONTENTS

ABBREVIATION LIST

AI	Artificial Intelligence
AR	Augmented Reality
CPD	Continuous Professional Development
GDPR	General Data Protection Regulation
MR	Mixed Reality
PBL	Problem-Based Learning
VR	Virtual Reality

SUMMARY

This briefing paper examines the transformative role of emerging pedagogical methods and digital technologies in contemporary physiotherapy education. While traditional approaches such as face-to-face lectures, hands-on practical sessions, and clinical apprenticeships remain fundamental, they are increasingly complemented by innovative strategies including Virtual Reality (VR), Artificial Intelligence (AI), and online simulations. These innovations address critical educational challenges, including variability in clinical placements limited access to people with complex or rare conditions, and the need for safe, repetitive skill practice.

The analysis highlights that while digital technologies improve learning outcomes and student engagement, their implementation faces significant challenges, including infrastructure limitations, financial costs, and the need for faculty training. The paper concludes that AI and digital tools should serve as complementary assets rather than replacements for core training. The recommended path forward is a blended learning model: one that integrates digital efficiency with the essential, people-centred skills of communication and empathy that define the physiotherapy profession.

1. INTRODUCTION

Physiotherapy education has traditionally relied on face-to-face lectures, hands-on practical sessions, and supervised clinical apprenticeships to prepare future practitioners. These conventional methods emphasise direct patient interaction, manual skill development, and observational learning under the guidance of experienced clinicians in real-world healthcare settings[1]. While these approaches remain foundational, the rapid advancement of digital technologies and pedagogical innovation have introduced transformative tools that enhance learning experiences, improve accessibility, and prepare students for modern healthcare challenges.

Emerging digital and innovative methods, such as virtual reality (VR), artificial intelligence (AI), online simulations, gamified learning modules etc, are reshaping physiotherapy education[2-5]. These technologies offer immersive, interactive, and personalised learning opportunities, bridging gaps in traditional training and enabling students to practice skills in risk-free virtual environments. Additionally, digital innovations facilitate remote learning, collaborative case-based discussions, and real-time feedback, making education more flexible and adaptive to individual needs. These innovations address also longstanding challenges in physiotherapy education, such as variability in clinical placement quality, limited access to people with rare conditions, and the need for repetitive skill practice[6].

This exploration of digital and innovative methods in physiotherapy education highlights their potential to complement and enhance traditional teaching approaches, ensuring that future physiotherapists are equipped with both foundational expertise and cutting-edge competencies[7]. Digital technologies can be considered not simply as tools, but integral parts of life-long learning and health care, applied ethically and responsibly as they develop.

As the healthcare landscape evolves, physiotherapy educators must strategically adopt these tools and methods to foster adaptability, evidence-based practice, and digital literacy in future graduates. This paper examines how these innovations can complement traditional approaches, equipping future physiotherapists with essential skills and digital literacy.

2. PURPOSE

This report explores the role of digital and innovative approaches in modern physiotherapy education. It aims to review emerging pedagogical methods and technologies, evaluate their benefits and challenges, and provide evidence-informed recommendations for educators, institutions and professional bodies

3. INNOVATIVE TEACHING METHODS

This section describes pedagogical approaches that promote active, experiential and student-centred learning. The principal methods, their characteristics, benefits, and limitations are summarised in Table 1.

Table 1: Innovative Teaching Methods in Physiotherapy Education

Teaching Method	Description	Detailed Benefits	Limitations and Challenges
Active Learning	Methods that encourage students to solve real-world problems and apply knowledge such as PBL, case studies, role-playing[8-10].	**Problem-Based Learning (PBL):** Enhances problem-solving, clinical reasoning, reflexivity, and sensitivity to patient needs[10-13]. **Case Studies:** Promotes deeper understanding, retention, and practical application of knowledge[9,14]. **Role-Playing:** Develops communication skills, empathy, teamwork, and critical thinking [14-17].	**Cognitive Load:** Can overwhelm novice students if not scaffolded correctly. **Resource Intensive:** Requires significant faculty time to design high-quality, realistic scenarios **Inconsistency:** Variability in the quality of peer interactions during role-play can affect learning outcomes[8, 11, 17].
Simulation-Based Learning	Using controlled environments (labs or virtual) to practice clinical skills safely[18, 19].	**Simulation Labs:** Enhances practical skill acquisition and clinical performance in a controlled, risk-free setting[16,18-23]. **Virtual Patients:** Offers interactive, real-life scenarios to practice decision-making. Allows for self-paced learning and repeated practice[24].	**Lack of Haptics:** Digital simulations often fail to replicate the tactile feedback essential for manual therapy. **Cost:** High financial investment for high-fidelity mannequins or lab maintenance. **Transferability:** Difficulty in transferring skills from a controlled environment to unpredictable real-life patient interactions[16,18,19,23].
Flipped Classroom	Students learn theory outside of class (e.g., via videos), using class time for interactive, practical activities[25].	Promotes active learning, student engagement, and greater satisfaction. Allows for more personalised feedback and interaction during class. Frees class time for hands-on practice and skill development[25-28].	**Preparation Dependency:** Relies heavily on student self-discipline; if students do not complete pre-class work, in-class activities fail. **Workload:** Significant front-loaded time investment for faculty to create video materials. **Passive Viewing:** Risk of students passively watching videos without genuine cognitive engagement[25,26].
Blended Learning	Combines online digital media (e.g., interactive modules) with traditional face-to-face teaching and practical sessions[22,29].	Enhances knowledge transfer, skill performance, flexibility, and accessibility. Caters to different learning preferences. Fosters higher student engagement and motivation[22,30-32].	**Disjointed Experience**: Risk of a disconnect between online modules and in-person practicals if not integrated well. **Tech Barriers**: Dependent on reliable internet and hardware availability for all students. **Social Isolation:** Reduced face-to-face peer interaction if the online ratio is too high[8,30,33].
Peer (Assisted) Learning	Involves students teaching and learning from each other through collaborative activities, group work, or peer simulation[34,35].	Fosters a supportive learning environment, sense of community, and enhances teamwork skills. Encourages active participation and promotes deeper understanding through discussion[34-36].	**"Blind Leading the Blind":** Risk of students reinforcing incorrect techniques or theory if not adequately supervised. **Personality Conflicts:** Interpersonal issues can hinder the learning process. **Variable Quality:** The quality of learning depends heavily on the peer tutor's ability to explain concepts clearly[34, 37].

3.1 Evaluation of Methodologies

Evaluating the effectiveness of innovative teaching methodologies is essential for continuous quality improvement in physiotherapy education. A combination of performance-based assessments, structured feedback surveys, learning analytics, and reflective evaluation can provide insights into student engagement, knowledge retention, clinical reasoning, and skill acquisition. Regular evaluation ensures alignment between teaching methods, intended learning outcomes, and professional competency standards, while supporting evidence-informed curriculum refinement[38].

3.2 Importance of Training the Trainers

Training the trainers is essential for the successful implementation of innovative teaching methodologies. Educators must be equipped with the necessary skills and knowledge to effectively facilitate active learning, utilise simulation technologies, and create engaging content for flipped classrooms and blended learning environments. Ongoing professional development and institutional support are critical to building digital pedagogical competence, addressing resistance to change, and fostering a positive and adaptive learning culture.

4. DIGITAL TECHNOLOGY IN EDUCATION

A range of digital technologies is being utilised to meet the evolving demands of healthcare. They have the potential to improve learning results, boost student engagement, and offer flexibility. However, implementing them involves notable challenges. Key technologies with their main benefits and challenges are summarised in Table 2.

5. INTEGRATION OF DIGITAL TECHNOLOGY AND AI IN PHYSIOTHERAPY EDUCATION

This section explains how digital tools can be embedded within curricula and highlights issues of governance and infrastructure.

The field of physiotherapy education is undergoing a significant transformation, driven by the integration of digital technologies. These tools are reshaping how students learn, practice, and develop the skills necessary for clinical practice[39].

As presented below (Table 2), a range of digital tools/technologies is now central to physiotherapy training. E-learning platforms and online course providers form the foundational layer for digital education. They host structured courses, webinars, and virtual classrooms, enabling the organised delivery of theoretical content. Interactive learning tools, including educational apps, simulation software, and online quiz platforms, provide dynamic ways for students to engage with complex anatomical and clinical concepts. These tools facilitate self-paced study and reinforce learning through practical application.

Beyond basic interactivity, immersive technologies (i.e. VR/AR/MR) offer profound advantages creating realistic clinical simulations and overlaying digital anatomical models onto the physical world[40,41]. To increase motivation, gamification incorporates game-like elements into the learning process, making skill acquisition more engaging.

Table 2: Digital Technologies in Education

Technology Category	Description	Key Examples	Primary Benefits in Physiotherapy Education	Challenges in Physiotherapy Education
E-Learning Platforms	Systems for delivering, tracking, and managing educational courses online.	Moodle, Blackboard, Coursera, edX, Webinars	**Flexible Learning:** Enables self-paced, remote study. **Access to Resources:** Centralises course materials and expert knowledge.	**Impersonal:** Can feel isolating and lacks the nuance of human interaction. **Engagement Drop:** High attrition rates if content is static or unengaging. **Maintenance:** Requires constant updating to prevent content from becoming obsolete.
Interactive Learning Tools	Digital applications and software that provide active, hands-on learning experiences.	PhysioU, Complete Anatomy, Quizlet, Anki, Simulation Software	**Enhanced Engagement:** Improves participation through interactive content. **Knowledge Retention:** Aids in memorising complex information (e.g., anatomy).	**Surface Learning:** Risk of students focusing on memorization (e.g., flashcards) rather than deep clinical reasoning. **Screen Fatigue**: Excessive use contributes to digital burnout. **Cost:** Subscription models can be expensive for students or institutions.
Immersive Technologies (VR/AR/MR)	Technologies that create or enhance a simulated environment for the user.	VR for clinical simulations, AR for anatomy visualisation, Mixed Reality (MR)	**Improved Clinical Skills:** Offers realistic, safe practice with virtual patients. **Enhanced Learning Experience:** Provides visual and hands-on understanding of complex subjects.	**Cybersickness:** Some users experience motion sickness or disorientation. **Hardware Limitations:** Headsets can be heavy, expensive, or tethered to PCs, limiting mobility **Tactile Void:** Cannot fully simulate the physical resistance or "feel" of patient tissue.
Gamification	The application of game-design elements in non-game contexts to motivate participation.	Leaderboards, Reward Systems, Motion-based games (Wii Fit, Kinect)	**Enhanced Engagement:** Increases student motivation and makes learning enjoyable. **Improved Retention:** Encourages repeated practice through challenges.	**Distraction:** Students may focus on "winning" or earning points rather than the learning objective. **Short-term Effect:** Novelty may wear off, leading to a drop in motivation over time. **Trivialisation:** Risk of oversimplifying complex clinical concepts to fit game mechanics.
Artificial Intelligence (AI)	Computer systems that can perform tasks typically requiring human intelligence.	AI Tutors/Chatbots, Automated Grading, Predictive Analytics, Adaptive Learning Paths	**Personalised Education:** Tailors content and feedback to individual student needs. **Efficient Assessment:** Provides automated, real-time feedback on performance. **Resource Efficiency:** Helps identify at-risk students for early intervention.	**Bias:** Algorithms may reflect historical biases in medical data. **Hallucinations:** Generative AI can confidently produce incorrect medical information. **Empathy Gap:** Cannot replace the human connection and empathy required in physiotherapy

Finally, AI is a crucial tool for increasing efficiency and enhancing health outcomes[42-44]. Educational institutions must prepare students to use AI critically and ethically in both academic and clinical contexts. AI can support learning with automated assessment and feedback, clinical reasoning assistance, personalised learning pathways, AI-assisted reflective practice and movement analysis and the same time to support students with disabilities or learning differences[45-47].

Educational institutions are responsible for providing the necessary infrastructure, support, and training to facilitate the effective and ethical integration of digital technologies and AI into education. Institutions should establish and uphold clear data governance policies and procedures regarding the use of digital and AI systems[48]. Continuous monitoring and evaluation of digital tools and their impact on education must be conducted to ensure ongoing alignment with pedagogical objectives and regulatory standards. Digital competencies, in general and related to AI in particular, should be integrated into relevant sections of the curriculum. All digital and AI usage must correspond with intended learning outcomes and be justified by sound pedagogical reasoning.

6. CHALLENGES OF DIGITAL TECHNOLOGY IN PHYSIOTHERAPY EDUCATION

While digital technology offers significant potential in physiotherapy education, its implementation faces considerable challenges, primarily stemming from technological and infrastructural barriers. Institutions often encounter substantial financial costs and technical hurdles, including a lack of reliable internet, adequate hardware, and user-friendly software platforms[49-51]. These limitations are not equally distributed; under-resourced institutions face a disproportionate burden, which risks exacerbating existing educational inequities and creating a digital divide where access to innovative learning tools becomes dependent on an institution's financial capacity.

Beyond infrastructure, a pervasive resistance to change among faculty presents a critical cultural and pedagogical limitation[52]. Many educators, trained in traditional hands-on methods, remain sceptical of digital tools, viewing them as inferior for developing essential clinical competencies. This sentiment is encapsulated in views such as, “Learning is about being active, but the digital is not really active.” Overcoming this deep-seated resistance requires more than just providing technology; it demands comprehensive faculty development programmes, institutional leadership, and time for educators to build digital pedagogical competence. Without this support, even the most sophisticated platforms risk being underutilised or misapplied, stifling innovation.

Furthermore, the shift to digital modalities raises complex questions about assessment integrity and the preservation of core physiotherapy skills. Digital simulations and virtual patients may not fully replicate the unpredictability of real-world clinical practice, including nuanced interpersonal communication, tactile feedback, and patient variability[39]. This gap complicates the valid and reliable evaluation of clinical readiness. Concurrently, there is a legitimate concern that excessive screen-based learning could erode the development of essential hands-on skills and therapeutic empathy[53].

From the student perspective, digital and innovative teaching methods offer both significant opportunities and notable challenges[22,54]. Evidence suggests that not all students benefit equally from increased digitalisation[30]. Learners with lower self-regulation skills may struggle in highly autonomous learning environments, while prolonged screen-based learning can

contribute to cognitive overload and digital fatigue[55]. Students have also expressed concerns about reduced opportunities for informal peer interaction, mentorship, and the development of professional identity when face-to-face contact is limited[56].

Therefore, a key limitation is the ongoing challenge of designing digital education that truly complements rather than compromises the holistic, person-centred competencies fundamental to the profession. Maintaining a balanced, blended approach that thoughtfully integrates digital innovation while safeguarding face-to-face, practical components is critical to preparing competent, confident physiotherapists for future practice[57].

7. FUTURE DIRECTIONS

The use of technology to innovate teaching methods will continue to develop as the technology evolves in sync with the learning styles of future students. This includes the maturation of virtual and augmented reality for immersive procedural simulation, telehealth platforms for teaching remote care competencies, and adaptive learning systems that tailor content to individual student progress. A central, parallel development in this future is the cultivation of advanced digital literacy for both students and educators[58]. This extends beyond basic technical proficiency to include the critical ability to evaluate digital tools for pedagogical soundness, evidence base, and alignment with learning outcomes. This evolution creates a more flexible, accessible, and engaging educational ecosystem, allowing students to master standardised skills in safe, repeatable digital environments before applying them in clinical practice.

AI, in particular, is a promising future direction, offering personalised learning and advanced simulation. However, this must be approached cautiously. AI is a complementary tool; it cannot replace the essential human-centred skills of communication, empathy, and manual handling and skills that define physiotherapy. Students must develop "AI literacy" to critically appraise AI outputs and understand potential biases. The goal is to create "AI-enabled" clinicians, not "AI-driven" ones, allowing professionals to concentrate on high-value, empathetic, hands-on patient care.

For faculty, this necessitates a shift toward roles as digital curators and facilitators, requiring sustained institutional investment in professional development to build confidence and competence in leveraging technology to enhance, rather than replace, human-centred teaching. Ultimately, the successful realisation of this digital future hinges on proactive ethical governance and a steadfast commitment to equity. Institutions must address significant challenges, including the digital divide in resource access, the high costs of advanced technologies, and the protection of data privacy (GDPR) within digital platforms.

8. CONCLUSION AND RECOMMENDATIONS

The integration of technology into physiotherapy education is not a static goal but an evolving process that must align with the changing learning styles of future students. As the profession moves forward, the focus must shift from simply adopting new tools to creating a sustainable ecosystem where digital innovation supports human-centred care. Successful integration involves overcoming infrastructure gaps, ensuring Faculty digital literacy, and maintaining key interpersonal skills[58,59]. Blended models that combine digital tools with traditional, people-centred teaching are likely to produce the most effective outcomes[22,32].

To successfully navigate this transition, institutions should consider adopting a phased roadmap aligned with recommendations for infrastructure, training, and pedagogy. One proposed feasible strategy contains three phases:

The **first phase** addresses the digital divide before any advanced tools can be deployed. It sets the foundation and infrastructure to ensure equitable access to technology. Educational institutions would invest in reliable internet, hardware, and essential software, which are prerequisites for all digital learning. Simultaneously, clear governance models for data privacy and the ethical application of digital tools are established within the institution.

The **second phase** involves competency building; technology is only as effective as the educators who utilise it. Educational institutions would continually equip teachers with the skills to deploy new technologies and promote active learning. They would integrate basic digital literacy, enhanced technology and AI ethics into the core physiotherapy curriculum to prepare students for a digital future.

The **third and final long-term phase** focuses on seamlessly integrating digital and physical methods to create a balanced, blended learning ecosystem. For example, digital simulations would be used for standardised skill acquisition, while face-to-face time is strictly reserved for refining manual techniques and interpersonal skills. In conclusion, learning analytics would be used to implement continuous assessment loops to monitor the effectiveness of these methods and adjust them based on student performance data[60].

In each case, while digital technologies enhance accessibility and efficiency, sustained attention is needed to ensure that physiotherapy education remains socially embedded, participatory, and grounded in human connection.

9. ACKNOWLEDGEMENTS

Members of the Education and Research Working Group of the Europe Region of World Physiotherapy for the 2024 - 2026 term:

Raf Meesen (Belgium), Lyubomira Sazdova (Bulgaria), Minettchen Herchenröder (Germany), Nikolaos Strimpakos (Greece) (lead), Gabriella Császár (Hungary), Stephen Lungaro Mifsud (Malta), Daniela Stanca (Romania), Tine Kovačič (co-lead) (Slovenia), Filiz Can (Turkey), Reena Patel (United Kingdom), Carmen Suárez (Chair).

In grateful memory of Lyubomira Sazdova, whose professionalism, generosity and commitment left a lasting mark on the Europe Region of World Physiotherapy.

REFERENCES

1. World Physiotherapy. Physiotherapist education framework 2021 [Available from: https://world.physio/what-we-do/education/physiotherapist-education-framework.
2. Glegg SMN, Levac DEL. Barriers, Facilitators and Interventions to Support Virtual Reality Implementation in Rehabilitation: A Scoping Review. PM&R. 2018;10(11):1237-51.
3. Veras M, Dyer J, Kairy D. Artificial intelligence and digital divide in physiotherapy education. Cureus. 2024;16(1):e52617.
4. Trentini F, Fante C, Manganello F, Testa M, Battista S. The use of digital technologies in physiotherapy higher education. Arch Physiother. 2025;15:49-58.
5. Topol E. Deep medicine: How artificial intelligence can make healthcare human again. New York: Basic Books; 2019.
6. Ødegaard N, Myrhaug H, Dahl-Michelsen T, Røe Y. Digital learning designs in physiotherapy education: A systematic review and meta-analysis. BMC Medical Education. 2020;21:48.
7. Isomursu M. EU project launched to prepare health workers for a digital future. Financial Times 2025 [Available from: https://www.ft.com/content/a56ef5a3-f5d8-446d-ae9b-f503cce20de7.
8. Tomé AM, Coelho JL. Physiotherapy education in the digital era: A roadmap of educational technologies for allied health educators. Handbook of Research on Instructional Technologies in Health Education and Allied Disciplines: IGI Global; 2023.
9. Guyet D, Saillot E. An innovative initial training program to encourage physiotherapists to reflect on clinical situations. Pédagogie Médicale. 2024;25(1):59-67.
10. De la Casa Almeida M, Suárez Serrano CM, Guichot Muñoz E. Meaningful and experiential learning in a fascial approach in practice education in the degree of physiotherapy: A pilot study at a Spanish university. Physiotherapy theory and practice. 2023;39(4):851-64.
11. Gunn H, Hunter H, Haas B. Problem-based learning in physiotherapy education: A practice perspective. Physiotherapy. 2012;98(4):330-5.
12. Ahmad KA, Malik FY, Hulbert JR. Student preference for case studies: Enhanced learning in a human physiology course. Medical Science Educator. 2012;22(3):140-4.
13. Rickard A, Yorke J, editors. ePBL: Investigating online resources to support problem based learning in physiotherapy education2008.
14. Guthrie LJ. Clinical case studies in physiotherapy: A guide for students and graduates. Edinburgh: Elsevier; 2009.
15. Grbavac V, Naletilić M, Šimić J. Impact of short-term patient education intervention on the teaching skills of physical therapy students: A randomized controlled trial. BMC Medical Education. 2024;24:815.
16. Sandoval-Cuéllar C, Alfonso-Mora ML, Castellanos-Garrido AL, Villarraga-Nieto AP, Goyeneche-Ortegón RL, Acosta-Otalora ML. Simulation in physiotherapy students for clinical decisions during interaction with people with low back pain: Randomised controlled trial. J Educ Health Promot. 2021;10:277.
17. Goothy SSK, Sirisha D, Swathi M. Effectiveness of academic role-play in understanding the clinical concepts in medical education. International Journal of Research in Pharmaceutical Sciences. 2019;10(2):1438-42.
18. Dairo YM, Hunter K, Ishaku T. The impact of simulation-based learning on the knowledge, attitude and performance of physiotherapy students on practice placement. BMC Medical Education. 2024;24:786.
19. Teisseire X, Rouvière F, Boussagol B, Perez-Roux T. The rehabilitation practice analysis training group: A teaching innovation for the professional training of physiotherapy students. Kinésithér Rev. 2018;18(193):21-6.
20. Blackford J, McAllister L, Alison J. Simulated learning in the clinical education of novice physiotherapy students. International Journal of Practice-based Learning in Health and Social Care. 2015;3(1):77-93.
21. Chernikova O, Heitzmann N, Stadler M, Holzberger D, Seidel T, Fischer F. Simulation-based learning in higher education: A meta-analysis. Review of Educational Research. 2020;90(4):499-541.

22. Pagels L, Schindler O, Luedtke K. Overview of styles, content, learning effects and attitudes of students towards digitally enhanced physiotherapy education: A scoping review. BMC Medical Education. 2025;25:176.
23. Wright A, Moss P, Dennis DM, Harrold M, Levy S, Furness AL. The influence of a full-time, immersive simulation-based clinical placement on physiotherapy student confidence during the transition to clinical practice. Adv Simul. 2018;3:3.
24. Mohammad RA, Ellingrod VL, Bleske BE. Implementing virtual patient cases in therapeutics education. Journal of the American College of Clinical Pharmacy. 2019;2(6):615-22.
25. Luginbuehl H, Nabecker S, Greif R, Zuber S, Koenig I, Rogan S. Transforming traditional physiotherapy hands-on skills teaching into video-based learning. BMC Medical Education. 2023;23(1):624.
26. Røe Y, Rowe M, Ødegaard NB, Sylliaas H, Dahl-Michelsen T. Learning with technology in physiotherapy education: Design, implementation and evaluation of a flipped classroom teaching approach. BMC Medical Education. 2019;19:291.
27. Honarpishe R. Design, implementation and evaluation of a flipped classroom for postgraduate physiotherapy students. Journal of Medical Research. 2024;18(1).
28. Hew KF, Lo CK. Flipped classroom improves student learning in health professions education: A meta-analysis. BMC Medical Education. 2018;18:38.
29. Lozano-Lozano M. A blended learning system to improve motivation, mood, and satisfaction in university students. International Journal of Environmental Research and Public Health. 2020;17(15):5365.
30. Swaminathan N, Ravichandran L, Ramachandran S, Milanese S. A comparison of physiotherapy students' perception about blended learning with online learning during COVID-19 pandemic: A mixed-method study. J Educ Health Promot. 2022;11:3.
31. Shahali S. Using e-learning methods for physiotherapy students: A blended learning approach. Eur J Physiother. 2023;25(5):268-75.
32. Balaraman T, Narasimman S, Zbigniew S, Marek K. Blended learning in physiotherapy education: Magic mix that improves quality of student learning. Fizjoterapia Polska. 2016;16(4):24-8.
33. Varma P, Lakshyashree, Chheda K, Goyal W, Agarwal T. Digital learning in physiotherapy education: Exploring design approaches through meta-analysis. Multidiscip Rev. 2023.
34. Salvitti S. Peer tutoring during clinical internships as experienced by physiotherapy students: A qualitative meta-synthesis. Advances in Health Sciences Education. 2025.
35. Christensen L, Hilde G, Eik H. Becoming a physiotherapist – A qualitative study exploring students' perspectives on peer assisted learning in physiotherapy education. Physiotherapy theory and practice. 2024;40(11):2604-16.
36. Paparella-Pitzel S. Exploring physical therapy students' experience of peer learning in a student-run clinic. Journal of Education and Health Promotion. 2021;10:350.
37. Gough S, Jones N, Hellaby M. Innovations in interprofessional learning and teaching: Providing opportunities to embed patient safety within the pre-registration physiotherapy curriculum. Physical Therapy Reviews. 2013;18(6):416-30.
38. Gokulakrishnan J, Franklin CVJ, Krishnaraja K. Teaching-learning methods in physiotherapy education: Merits and demerits. International Journal of Health Sciences and Research. 2023;13(10):220-4.
39. American Physical Therapy Association. The digitally enabled physical therapist: An APTA foundational paper. 2022.
40. Bridge P, Adeoye J, Edge CN, Garner VL, Humphreys AL, Ketterer SJ. Simulated placements as partial replacement of clinical training time: A Delphi consensus study. Clinical Simulation in Nursing. 2022;68:42-8.
41. Deaves A. Exploring alternative practice placement models in health professions education: A qualitative systematic review. BMC Medical Education. 2024;24:6323.
42. World Economic Forum. 7 ways AI is transforming healthcare 2025 [Available from: https://www.weforum.org/stories/2025/08/ai-transforming-global-health/.
43. Cirillo D, Catuara-Solarz S, Morey C, Guney E, Subirats L, Mellino S. Sex and gender differences and biases in artificial intelligence for biomedicine and healthcare. NPJ Digital Medicine. 2020;3:81.

44. Lowe SW. The role of artificial intelligence in physical therapy education. Bulletin of Faculty of Physical Therapy. 2024;29:13.
45. El-Sobkey SB, Kelini KI, ElKholy M, Abdeldayem T, Abdallah M, Mohamed DAA. Acceptance of AI-powered chatbots among physiotherapy students: International cross-sectional study. JMIR Medical Education. 2025;11:e76574.
46. Mikołajewska E, Masiak J, Mikołajewski D. Applications of artificial intelligence-based patient digital twins in decision support in rehabilitation and physical therapy. Electronics. 2024;13(24):4994.
47. Tozsin A, Ucmak H, Soyturk S, Aydin A, Gozen AS, Fahim MA, et al. The Role of Artificial Intelligence in Medical Education: A Systematic Review. Surg Innov. 2024;31(4):415-23.
48. Reddy S, Allan S, Coghlan S, Cooper P. A governance model for the application of AI in health care. Journal of the American Medical Informatics Association. 2020;27(3):491-7.
49. Sytnik T, Kozlova L. The use of digital technologies in the training of physical therapy specialists in medical institutions of higher education. Cherkasy Univ Bull Pedagog Sci. 2025.
50. Olivier B, Verdonck M, Caseleijn D. Digital technologies in undergraduate and postgraduate education in occupational therapy and physiotherapy: A scoping review. JBI Evidence Synthesis. 2020;18(5):863-92.
51. Borges do Nascimento IJ, Abdulazeem H, Vasanthan LT, Martinez EZ, Zucoloto ML, Østengaard L. Barriers and facilitators to utilizing digital health technologies by healthcare professionals. NPJ Digital Medicine. 2023;6(1):161.
52. Ødegaard N, Røe Y, Dahl-Michelsen T. "Learning is about being active, but the digital is not really active": Physiotherapy teachers' attitudes toward and experiences with digital education. Physiotherapy theory and practice. 2022;39(7):1399-411.
53. Sauerbrei A, Kerasidou A, Lucivero F, Hallowell N. The impact of artificial intelligence on the person-centred, doctor-patient relationship: Some problems and solutions. BMC Med Inform Decis Mak. 2023;23:73.
54. Sillero-Sillero A. Effectiveness of a heart disease blended learning program in physiotherapy students: A prospective study. Front Cardiovasc Med. 2023.
55. van Lankveld W, Maas M, van Wijchen J, Visser V, Staal JB. Self-regulated learning in physical therapy education: a non-randomized experimental study comparing self-directed and instruction-based learning. BMC Med Educ. 2019;19(1):50.
56. Chesterton P, Richardson M, Tears C. Student physiotherapists perceptions of online curriculum delivery during the COVID-19 pandemic. BMC Med Educ. 2022;22(1):440.
57. Xu T, Weng H, Liu F, Yang L, Luo Y, Ding Z, et al. Current status of ChatGPT use in medical education: Potentials, challenges, and strategies. JMIR Med Educ. 2024;10:e57896.
58. Ng DTK, Leung JKL, Chu SKW, Qiao MS. Conceptualizing AI literacy: An exploratory review. Computers and Education: Artificial Intelligence. 2021;2:100041.
59. Ihegihu EY, Kasarachi, F. G., Wale-Aina, D. A., Ihegihu, C. C., & Akudo, A. C. . A Comparative Analysis of Blended and Traditional Learning Methods in Clinical Physiotherapy: Student Perceptions and Satisfaction. International Journal of Research and Innovation in Social Science. 2025;IX(IIIS):1073-81.
60. Dixon N, Howe R, Richter UM. Exploring learning analytics practices and their benefits through the lens of three case studies in UK higher education. Research in Learning Technology. 2025;33.