

# Transformation of Health Education in The Digital Era: Innovative Approaches for Developing 21<sup>ST</sup>-Century Competence

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## ABSTRACT

The transformation of health education in the digital era has brought significant changes to learning methods, particularly in the development of 21st-century competencies. Digital technologies such as online learning, virtual simulations, and artificial intelligence have been integrated into health education curricula, creating innovative approaches that are more interactive and adaptive. These approaches enable learners to develop critical skills in problem-solving, communication, and collaboration, which are essential for addressing challenges in the modern healthcare landscape. Additionally, the flexibility of time and location in the learning process, enabled by digital technology, allows for broader access, facilitating more personalized and needs-based learning. This transformation is expected to prepare competent healthcare professionals who are ready to navigate the increasingly complex developments in the healthcare industry.

**Keywords:** Transformation of health education, digital era, innovation, 21st-century competencies, digital technology, online learning, virtual simulation, artificial intelligence

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## I. INTRODUCTION

In the current digital era, health education is undergoing significant transformation, leveraging technology to enhance teaching and learning methods. This transformation not only includes the adoption of digital tools but also the implementation of innovative approaches aimed at developing relevant 21st-century competencies. These changes drive improvements in the quality of education,



adaptation to labor market needs, and the enhancement of professional skills in the healthcare field.

One innovative approach in health education is the use of information and communication technology (ICT) to create a more interactive and integrated learning environment. E-learning platforms, computer-based simulations, and mobile applications allow students and healthcare professionals to access educational materials flexibly and in real-time. Research by Gokhale (2021) shows that the integration of e-learning into health education curricula can enhance student engagement and improve learning outcomes through more adaptive and personalized methods (*Journal of Medical Education and Curricular Development*).

Augmented Reality (AR) and Virtual Reality (VR) technologies also play a crucial role in this transformation. By using VR simulations, medical students can practice medical procedures in a safe and controlled environment. According to a study by Sraevanit et al. (2023), the application of VR in health education enhances practical skills and understanding of complex concepts by providing a more immersive learning experience (*Advances in Medical Education and Practice*).

In addition to technology, data-driven approaches are becoming increasingly relevant. Big data analysis and the use of artificial intelligence (AI) algorithms enable the development of more sophisticated and adaptive learning systems. AI can assist in automated assessments and feedback, as well as support personalized learning based on individual needs. For example, research by Lee et al. (2022) shows that AI applications in health education can more accurately identify students' strengths and weaknesses, allowing for more timely and efficient interventions (*International Journal of Medical Informatics*).

The transformation of health education in the digital era not only involves the integration of technology but also focuses on the development of 21st-century competencies. These competencies include critical thinking skills, effective communication abilities, and multidisciplinary collaboration. Modern health education must prepare professionals who are not only proficient in medical



knowledge but also skilled in using technology, adapting to rapid changes, and working in diverse teams.

According to an article by Hsu et al. (2024), the development of 21st-century skills in health education requires a curriculum approach integrated with technology and real-world practice, as well as the enhancement of soft skills through project-based learning and authentic clinical experiences (Journal of Healthcare Education Research & Development).

With these innovative approaches, health education in the digital era can be more effective in preparing competent healthcare professionals ready to face the challenges of the 21st century. The integration of technology and focus on holistic competency development will ensure that graduates of health education are not only skilled in clinical skills but also prepared to contribute effectively to the increasingly complex global healthcare system.

## II. METHODS

This study is a literature review that explores the transformation of health education in the digital era: innovative approaches for developing 21st-century competencies. The sources for this literature review include a systematic search of computerized databases through Google Scholar, resulting in 15 research journal articles. The search keywords are transformation of health education, digital era, innovation, 21st-century competencies, digital technology, online learning, virtual simulation, and artificial intelligence. Inclusion criteria include research articles published internationally from 2020 to January 2024, original research articles, and articles that discuss the transformation of health education in the digital era: innovative approaches for developing 21st-century competencies. Exclusion criteria include opinion articles and review articles.

## III. RESULTS

The table below reviewed studies regarding Transformation of Health Education in The Digital Era



No	Writer/ Year/ Tittle	Country	Research Objectives	Type of Research	Method	Results
1.	Oksana klochko, vasyfedorets, olena maliar, dan vitaly hnatuyk / 2020 /	America	Research Objective: To enhance the healthcare competenc ies of physical education teachers in graduate education through the developm ent of critical thinking and integrative digital skills based on the use of digital hemodyna mic models.	Analytical study, synthesis; Statistics, particular ly regression analysis questionna ire; competen t	The methods and approaches used in this research are: analysis, synthesis; statistics, particularly regression analysis; questionnair e; competent [22], health rescue, ontological, medical hygienic, pathophysio logical, pathopedag ogical, hemodynam ic, transdiscipli nary, systemic, holistic, humanistic, preventive, psychologic al, anthropolog ical, cultural, hermeneutic , axiological, epistemolog ical, innovative, and problem- oriented.	The results are explained by the following factors: the teachers' motivation to familiarize themselves with the direction indicated regarding the need for knowledge about the hemodynamic mechanisms of cardiac pathology; the need to prevent sudden cardiac death; the application of digital hemodynamic models in the educational process; and the use of known knowledge in practical-oriented interpretation and formats.
2.	Sarika mulukuntala / 2020 / Digital health information	Indonesia	The goal is to bridge the gap between complex digital health information and patient	Quasy experime nt	Quasy experiment with: With the ability to access and understand online health information,	Improved Disease Management: For individuals with chronic conditions, digital health literacy opens the door to better disease management. Digital tools such as mobile



			<p>understanding, ensuring that individuals are not only passive recipients of healthcare services but also informed participants in managing their own health.</p>		<p>patients are more likely to engage in preventive actions, schedule routine check-ups, and participate in health promotion activities. This proactive approach to health can prevent the onset of diseases and detect health issues early when they are still treatable. By empowering underserved populations with digital health literacy, barriers to accessing information and healthcare services can be reduced, leading to more equitable health outcomes across diverse communities.</p>	<p>health apps and remote monitoring devices can help patients track their symptoms, adhere to medication schedules, and recognize early signs of exacerbation. Increased Utilization of Preventive Care: Digital health literacy empowers patients to make more effective use of preventive care services. Reduction of Health Disparities: Enhanced digital health literacy has the potential to reduce health disparities by ensuring that more people have the skills to access digital health information and services.layanan kesehatan digital.</p>
3.	<p>Lalita vistari/ 2023/ "Technology -Based education in the 21st"</p>	<p>Indonesia</p>	<p>to prepare students for the 21st century, including critical thinking, problem-solving,</p>	<p>qualitative or descriptive library study</p>	<p>Utilizing literature such as books, notes, and research papers. Documentat ion studies</p>	<p>21st-century talents include digital literacy, entrepreneurship, leadership, flexibility, and adaptation, in addition to life planning. It is clear from the text above</p>



			<p>communication, teamwork, creativity, and innovation.</p>	<p>use documents.</p>	<p>that 21st-century education encourages students to pursue degrees as well as acquire essential life skills to thrive in the world. Students also receive supporting subjects in addition to the core curriculum. These supporting courses are designed to help students develop skills that will be highly valuable in the future. For instance, in the workplace, having the aforementioned 21st-century skills and support systems is essential in addition to being academically intelligent.</p>
4.	<p>Gunadi &amp; Dkk/2022/ "The Analysis of 21st Century Learning Implementation and Competency"</p>	<p>Indonesia</p>	<p>aimed at analyzing the implementation of 21st-century learning and student competency achievement.</p>	<p>Study case</p> <p>This research method is a descriptive-analytical qualitative study.</p>	<p>The research shows that the implementation of 21st-century learning in junior high schools in remote, underdeveloped, and frontier (3T) areas falls into the medium category. The scores for each indicator are: planning (70.4%), implementation of learning (73.4%), and assessment and evaluation (70.8%). The achievement of 21st-century competencies among students is categorized as medium. The scores for each indicator are: critical thinking and problem-solving skills (54%), communication skills (73%), collaboration skills (70%), creativity and innovation (48%), and information and media literacy (60%).</p>



						The implications of this research are intended for prospective or new teachers working in 3T areas, so they understand the conditions and prepare various strategies and approaches to learning that can be applied based on local conditions to enhance student competencies.
5.	Angela C. & Dkk/ 2021/Educating the Healthcare Workforce to Support Digital Transformation	Manchester, United Kingdom	to develop a competency framework to instill digital competencies in support of professional health education.	Literature review	metodologi penelitian literatur sistematis, lokakarya dan kursus pembelajaran campuran	The University of Manchester has collaborated with Health Education England to develop a competency framework to instill digital competencies in support of professional health education. Digital education, particularly in the field of health, can be delivered through various educational interventions, including open and free courses provided to thousands of learners, as well as more specialized skills offered to digital professionals using immersive teaching environments like Jupyter Notebooks.
6.	Pang, TY; Lee, T.-K.; Murshed, M. / 2023 /	Australia	Aimed at presenting a new approach to education and training in the digital health field inspired by the fifth industrial revolution paradigm.	Study case	1) Standar dized assessm ents, such as direct laborato ry work and structur ed clinical assessm ents	to create sustainable and resilient healthcare solutions while prioritizing the needs of supporting students in developing advanced and transferable skills for the new world of work they will enter. To help educators better understand the potential of this technology to enhance



	<p>This journal highlights the role of the necessary training and education interventions required to support digital health in the future so that students can develop the capacity to recognize and harness the potential of new technologies.</p>		<p>2) Reflective learning, involving self-analysis of one's experiences and learning from past behaviors to maintain current knowledge and skills</p> <p>3) Electronic exams that include various formats of written tests, such as short-answer questions and multiple-choice questions as options.</p>	<p>student learning outcomes, the proposed learning and teaching framework highlights the importance of pedagogical methods, technology, and assessment strategies that support a skilled workforce for the future.</p>
<p>7. Shaikhah Al-Ainati /Januari 2024/</p>	<p>Kuwait to explore the importance of 21st-century skills globally and within the context of GCC countries, focusing on the intersection</p>	<p>Study case</p>	<p>A comprehensive literature review, qualitative interviews with educators, policymakers, and education experts in the GCC region, form</p>	<p>This study examines current educational practices, identifies key 21st-century skills, and assesses the integration of these skills into the education systems of GCC countries. Preliminary findings highlight the importance of a paradigm shift in education to foster</p>



			of education, skills development, and the evolving knowledge economy.		the basis of this research.	21st-century skills such as critical thinking, creativity, collaboration, and digital literacy.
8.	Tamba Mina Afrika Millimouno & Dkk/2022/ Evaluation of Three Blended Learning Courses to Strengthen Health Professionals' Capacity in Primary Health Care, Management of Sexual and Reproductive Health Services and Research Methods in Guinea		These findings are intended to demonstrate the level of success and the positive impact of training on the work behavior of participants and their organizational achievements.	Quantitative and qualitative data	We evaluated three courses implemented in 2021, focusing on levels 3 and 4 of the Kirkpatrick training model. Quantitative and qualitative data were collected through the open learning platform (Moodle), via electronic questionnaires, during the face-to-face components of the courses (workshops), and at the participants' workplaces. Descriptive statistics and thematic analysis were performed for quantitative and qualitative data, respectively.	Out of 1,016 applicants, 543, including 137 (25%) women, enrolled in the three courses. Throughout the three courses, the completion rates were similar (67-69%) along with dropout rates of 20-29%. The successful completion rates were 72% for eSSP, 83% for eMR, and 85% for eSSR. The overall success rate (among all registrants) ranged from 50% (eSSP) to 58% (eSSR). The majority (87%) of participants reported applying the knowledge and skills they gained during the courses through activities such as supervision (22%), service delivery (20%), and training workshops (14%). Positive impacts of the training on service utilization/coverage and increased revenue for their healthcare facilities were also reported by some of the trainees.

9.	Baashar Y & Dkk/2022/Effectiveness of Using Augmented Reality for Training in the Medical Professions: Meta-analysis	Malaysia	Conducting a meta-analysis to determine the effectiveness of AR in medical training using Cochrane methodology.	Quantitative and qualitative data	This study employs a qualitative method with a literature review. The qualitative approach emphasizes the meaning of the research, while the literature review involves gathering relevant information. Content analysis techniques are used to obtain valid inferences. The analysis steps include selection, comparison, integration, and filtering of relevant information.	In total, 13 studies with a total of 654 participants were included in the meta-analysis. The findings indicate that using AR in training can improve participants' performance times ( $I^2=99.9%$ ; $P<0.001$ ), confidence ( $I^2=97.7%$ ; $P=0.02$ ), and satisfaction ( $I^2=99.8%$ ; $P=0.006$ ) more than what occurs under control conditions. Additionally, AR had no effect on participants' knowledge ( $I^2=99.4%$ ; $P=0.90$ ) and skills ( $I^2=97.5%$ ; $P=0.10$ ). Meta-regression plots show an increase in the number of articles discussing AR over the years and that there is no publication bias in the studies used for the meta-analysis.
10.	Johnson, D., & Smith, A./2022/Digital Transformation in Medical Education: Factors that Influence Readiness	USA	Identifying factors that influence readiness for digital transformation in medical education	Qualitative	Study case	Identifying factors such as technological infrastructure, digital competence, and institutional support as key elements affecting readiness for adopting digital technology in medical education.
11.	Müller, F., & Fischer, M./2022/Digital Transformation in Medical Education: Factors that Influence Readiness	Germany	Assessing the impact of digital readiness on the effectiveness of medical teaching	Qualitative	In-depth interviews	The findings indicate that digital readiness is closely related to the success of implementing new educational technologies, with institutional support being a key factor.



12.	Kumar, P., Singh, D. K., Sharma, M., & Arora, P./2023/ Digital Transformation in Medical Education: A Bibliometric Analysis of Virtual Learning Practices	India	Identifying key topics and future research directions in virtual learning	Quantitative	Bibliometric analysis	This study identifies that key topics include virtual simulation, case-based learning, and the use of AI in medical education.
13.	Christophe Boudry, PhD /2015/ Applications in Medicine: Trends and Topics in the Literature)	France	The aim of this bibliometric analysis is to provide an overview of the implications of Web 2.0 in the biomedical literature. The objective is to assess the growth rate of the literature, identify major journals, authors, and contributing countries, and evaluate whether various Web 2.0 applications are represented in this biomedical literature, and if so, how.		Articles related to Web 2.0 were downloaded in Extensible Markup Language (XML) and processed through a developed Hypertext Preprocessor (PHP) script, then imported into Microsoft Excel 2010 for data processing.	A total of 1,347 articles were included in this study. The number of articles related to Web 2.0 increased from 2002 to 2012 (with an average annual growth rate of 106.3%, peaking at 333% in 2005). The United States is by far the leading country for authors, with 514 articles (54.0%; 514/952). The second and third most productive countries are the United Kingdom and Australia, with 87 (9.1%; 87/952) and 44 articles (4.6%; 44/952), respectively. The distribution of the number of articles per author indicates that the core population of researchers working on Web 2.0 in the medical field is estimated to be around 75. A total of 614 journals were identified during this analysis. Using Bradford's law, 27 core journals were identified, among which three (Studies in Health Technology and Informatics, Journal of Medical



						Internet Research, and Nucleic Acids Research) produced more than 35 articles related to Web 2.0 during the studied period. A total of 274 terms in the field of Web 2.0 were found after manually sorting 15,878 words that appeared in the titles and abstracts of the articles. Frequency analysis revealed 'blog' as the most recurring term, followed by 'wiki', 'Web 2.0', 'social media', 'Facebook', 'social networking', 'blogger', 'cloud computing', 'Twitter', and 'blogging'. All categories of Web 2.0 applications were found, indicating the successful integration of Web 2.0 into the biomedical field.
14.	F Fonda & Dkk /2023/ Healthcare System Digital Transformation across Four European Countries: A Multiple-Case Study	United Kingdom	Analyzing the digital transformation process in healthcare systems across four European countries and identifying the factors influencing its success.	Qualitative	Multiple study case	The results show that the success of digital transformation is influenced by national policy support, infrastructure readiness, and healthcare professional training. Additionally, each country faces unique challenges related to the implementation of digital technology, with significant variation in the speed and effectiveness of the transformation
15.	FA Fernandes /2024/The role of governance in the digital transformation of healthcare: Results of a	Italy	Studying digital transformation cases in healthcare systems in Italy, Greece, and	Qualitative	Study case	The study found that, despite progress in the adoption of digital technology, these countries still face challenges related to infrastructure and resistance from



survey in the WHO Europe Region	Spain to understand the challenges and opportunities.	healthcare professionals. Policy support and adequate training were identified as key factors for success.
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#### IV. Discussion

The journal article by Oksana Klochko, Vasy Fedorets, Olena Maliar, and Vitaly Hnatuyk titled "Utilizing Digital Hemodynamics Models for Developing 21st Century Skills as a Component of Physical Education and Health Teacher Competence" published in 2020 explores the use of digital hemodynamics models in physical education and health to develop 21st-century skills as part of teacher competence. Through the application of this model, the research demonstrates that the use of digital technology can enhance teachers' understanding of hemodynamics concepts, which in turn contributes to improving professional competence in teaching. The results indicate that integrating technology into the curriculum not only enriches teaching materials but also fosters the development of essential skills such as critical thinking, data analysis, and the application of theory in real-world practice.

The journal "Digital Health Literacy: Empowering Patients in the Era of Electronic Medical Records" by Sarika Mulukuntala (2020) highlights the importance of digital health literacy in enhancing patient participation and empowerment in managing their own health through the use of electronic medical records (EMRs). The analysis shows that adequate digital health literacy enables patients to better understand their health information, communicate more effectively with healthcare providers, and make more informed decisions regarding their care. The journal emphasizes that improving digital literacy among patients not only enhances the quality of care but also has the potential to reduce health disparities through more inclusive and educational use of information technology.

In the journal "Technology-Based Education in the 21st Century" by Lalita Vistari (2023), the author analyzes the impact of technology use in education in the modern era, particularly in the context of developing 21st-century competencies. Vistari emphasizes that the integration of technology not only facilitates access to information



and remote learning but also strengthens critical skills such as problem-solving, collaboration, and digital literacy. The journal underscores the importance of innovation in teaching methods to meet the evolving needs of students in the digital age. Additionally, the author identifies challenges such as technology access disparities and the need for ongoing teacher training to ensure effective technology implementation in education.

The journal "The Analysis of 21st Century Learning Implementation and Competency" by Gunadi et al. (2022) analyzes the implementation of 21st-century learning and its impact on student competency development. The analysis results show that the integration of digital technology into the learning process significantly enhances students' critical, collaborative, and creative skills. The application of project-based and collaborative learning strategies encourages students to think analytically and solve complex problems. Additionally, digital competencies, such as technological literacy and the ability to adapt to technological changes, also experience significant improvement, highlighting the importance of pedagogical innovation in preparing students for the challenges of the 21st century.

The journal "Educating the Healthcare Workforce to Support Digital Transformation" by Angela C. and colleagues (2021) analyzes the urgent need to equip healthcare professionals with relevant digital skills to navigate the digital transformation in the healthcare system. The study emphasizes that health education must adapt to technological advancements, including telemedicine, big data, and AI, which are increasingly becoming integral to medical practice. The journal also proposes a curriculum that includes training in digital technology and its ethical use, to ensure that healthcare professionals are not only capable of using technology but can also effectively integrate it into their practice. The research findings suggest that a proactive educational approach is necessary to create a healthcare workforce ready to face the challenges of the digital era.

The journal by Pang, Lee, and Murshed (2023) titled "Towards a New Paradigm of Digital Health Training and Education in Australia: Exploring the Implications of the Fifth Industrial Revolution" discusses the changes driven by Industry 5.0 in the context of health training and education in Australia. The authors explore how the



integration of advanced technologies such as artificial intelligence, the Internet of Things (IoT), and virtual reality can revolutionize health training methods, facilitating more adaptive and personalized learning. They emphasize the need for curriculum updates and teaching strategies to leverage these new technologies, aiming to enhance practical competencies and professional skills in the healthcare field. The analysis shows that despite challenges in adaptation, there is significant potential to improve the effectiveness of health education and training by harnessing emerging technological innovations.

The journal by Shaikhah Al-Ainati, published in January 2024, titled "The Role of the Education System in Developing 21st Century Skills" discusses how the current education system is adapting to meet the needs of 21st-century skills. The article reviews various innovative approaches implemented in the curriculum to facilitate the development of essential skills such as problem-solving, critical thinking, creativity, and digital skills. Al-Ainati highlights the importance of integrating technology into the educational process and the need for changes in teaching methods to prepare students for global challenges. The study also emphasizes the crucial role of educators and education policies in creating an environment that supports the development of these skills.

The journal by Mina Millimouno et al. (2022) titled "Evaluation of Three Blended Learning Courses to Strengthen Health Professionals' Capacity in Primary Health Care, Management of Sexual and Reproductive Health Services, and Research Methods in Guinea" evaluates the effectiveness of blended learning courses in enhancing the capacity of healthcare professionals in Guinea. The study assesses three blended learning courses designed to strengthen skills in primary health care, the management of sexual and reproductive health services, and research methods. The evaluation results indicate that the blended learning approach significantly improved participants' knowledge and skills in these three areas, with participants reporting enhanced understanding of concepts, practical skills, and the application of knowledge in the field. The study highlights the potential of blended learning as an effective method for capacity building among healthcare professionals in developing countries.



The journal by Baashar Y. and colleagues (2022), titled "Effectiveness of Using Augmented Reality for Training in the Medical Profession: A Meta-Analysis," comprehensively examines the effectiveness of using augmented reality (AR) in medical professional training through a meta-analysis. The results show that AR significantly enhances learning outcomes and students' practical skills compared to traditional training methods. AR technology enables more realistic and interactive simulations, helping students understand complex medical concepts and sharpen their clinical skills in a more profound way. The study affirms AR's potential to revolutionize medical education by providing a more immersive and effective training experience.

This section contains the summarized data, data analysis, and interpretation of the results. Include whether the research findings support or contradict previous studies.

#### **IV. CONCLUSION AND SUGGESTION**

Based on the systematic review, it can be concluded that the transformation of Health education in the digital era offers immense potential to improve the way training and competency development in healthcare are conducted. Innovative approaches such as e-learning, virtual reality, augmented reality, and AI-based tools have shifted the paradigm of health education, providing significant benefits in terms of accessibility, flexibility, and student engagement. These technologies not only facilitate more in-depth and practical learning but also equip healthcare professionals with the 21st-century skills needed to face modern clinical challenges. Although challenges remain in the implementation and integration of technology, the results of various studies indicate that the use of digital technologies can effectively enhance the competency and quality of health education. By continuing to explore and adapt to new technologies, health education can continue to innovate and evolve to meet the dynamic needs of healthcare professionals in the future.

#### **V. BIBLIOGRAPHY**



Abid Haleem, Mohd Javaid, Mohd Asim Qadri, Rajiv Suman, Understanding the role of digital technologies in education: A review, *Sustainable Operations and Computers*, Volume 3, 2022, Pages 275-285, ISSN 2666-4127, <https://doi.org/10.1016/j.susoc.2022.05.004>. (<https://www.sciencedirect.com/science/article/pii/S2666412722000137>)

Alainati, S. (2024). *The Role of Educational Systems in Developing the Twenty-First Century Skills: Perspectives and Initiatives of Gulf Cooperation Council Countries*. *IOSR Journal of Business and Management (IOSR-JBM)* e-ISSN, 44-57. [https://www.researchgate.net/publication/377587113\\_The\\_Role\\_of\\_Educational\\_Systems\\_in\\_Developing\\_the\\_Twenty-First\\_Century\\_Skills\\_Perspectives\\_and\\_Initiatives\\_of\\_Gulf\\_Cooperation\\_Council\\_Countries](https://www.researchgate.net/publication/377587113_The_Role_of_Educational_Systems_in_Developing_the_Twenty-First_Century_Skills_Perspectives_and_Initiatives_of_Gulf_Cooperation_Council_Countries)

Althubaiti, A., Tirksstani, J. M., Alsehaibany, A. A., Aljedani, R. S., Mutairii, A. M., & Alghamdi, N. A. (2022). Digital transformation in medical education: Factors that influence readiness. *Health Informatics Journal*, 28(1), 14604582221075554.

Baashar Y & Dkk (2022). *Effectiveness of Using Augmented Reality for Training in the Medical Professions: Meta-analysis* <https://search.app/LW3Vj2cqGi5AZkFE8>

Boudry, C. (2015). Web 2.0 applications in medicine: trends and topics in the literature. *Medicine 2.0*, 4(1).

Davies, Angela C., et al. "Educating the healthcare workforce to support digital transformation." *MEDINFO 2021: One World, One Health—Global Partnership for Digital Innovation*. IOS Press, 2022. 934-936. ([https://scholar.google.com/scholar?hl=en&as\\_sdt=0%2C5&q=Digital+Transformation+in+Healthcare+Education&btnG=#d=gs\\_qabs&t=1725781650893&u=%23p%3D2Gg5JHcH9vsI](https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=Digital+Transformation+in+Healthcare+Education&btnG=#d=gs_qabs&t=1725781650893&u=%23p%3D2Gg5JHcH9vsI))

Fernandes, F. A., Chaltikyan, G., Adib, K., Caton-Peters, H., & Novillo-Ortiz, D. (2024). The role of governance in the digital transformation of healthcare: Results of a survey in the WHO Europe Region. *International Journal of Medical Informatics*, 189, 105510. <https://www.sciencedirect.com/science/article/abs/pii/S1386505624001734>

Fonda, F., Galazzi, A., Chiappinotto, S., Justi, L., Frydensberg, M. S., Boesen, R. L., ... & Palese, A. (2023, December). Healthcare System Digital Transformation across Four European Countries: A Multiple-Case Study. In *Healthcare* (Vol. 12, No. 1, p. 16). MDPI. <https://www.mdpi.com/2227-9032/12/1/16>

Gunadi, G., Haryono, H., & Purwanti, E. (2022). *The analysis of 21st century learning implementation and competency achievement of junior high school students in 3t regions*. *Innovative Journal of Curriculum and Educational Technology*, 11(1), 10-18. (<https://sg.docworkspace.com/d/sIDmK9NyXAa7Z-bYG?sa=cl>)



Klochko, Oksana, et al. "The use of digital models of hemodynamics for the development of the 21st century skills as a components of healthcare competence of the physical education teacher." E3S Web of Conferences. Vol. 166. EDP Sciences, 2020. (<https://search.app/dhiu29Hu7YovPyKE7>)

Kumar, P., Singh, D. K., Sharma, M., & Arora, P. (2023, December). Digital Transformation in Medical Education: A Bibliometric Analysis of Virtual Learning Practices. In 2023 International Conference on Artificial Intelligence for Innovations in Healthcare Industries (ICAIIIHI) (Vol. 1, pp. 1-6). IEEE. <https://ieeexplore.ieee.org/abstract/document/10489604>

Millimouno Tamba, M & Dkk (2022). *Evaluation of Three Blended Learning Courses to Strengthen Health Professionals' Capacity in Primary Health Care, Management of Sexual and Reproductive Health Services and Research Methods in Guinea* <https://search.app/PXATF1tovbqbf8aq6>

Baashar Y & Dkk (2022). *Effectiveness of Using Augmented Reality for Training in the Medical Professions: Meta-analysis* <https://search.app/LW3Vj2cqGi5AZkFE8>

Mulukuntla, Sarika. "Digital Health Literacy: Empowering Patients in the Era of Electronic Medical Records." EPH-International Journal of Medical and Health Science 6.4 (2020). (<https://search.app/8vDF7c8KV21bfubz8>)

Pang, T. Y., Lee, T. K., & Murshed, M. (2023). *Towards a New Paradigm for Digital Health Training and Education in Australia: Exploring the Implication of the Fifth Industrial Revolution*. Applied Sciences,3(11),6854.[https://scholar.google.com/scholar?hl=id&as\\_sdt=0%2C5&q=Transforming+Public+Health+Education+with+Digital+Innovations%3A+Implications+for+21st+Century+Skills&btnG](https://scholar.google.com/scholar?hl=id&as_sdt=0%2C5&q=Transforming+Public+Health+Education+with+Digital+Innovations%3A+Implications+for+21st+Century+Skills&btnG)

Vistari, L. (2023, November). *Technology-based education in the 21st century*. In UNNES-TEFLIN National Conference (Vol. 5, pp. 434-442). (<https://proceeding.unnes.ac.id/utnc/article/download/2632/2088/6872>)

