Handbook of Research on

Instructional Technologies in Health Education and Allied Disciplines

Manuel Bautista Garcia, Mildred Vanessa Lopez Cabrera,
and Rui Pedro Pereira de Almeida

IGI Global
PUBLISHER of TIMELY KNOWLEDGE

Handbook of Research on Instructional Technologies in Health Education and Allied Disciplines

Manuel B. Garcia
FEU Institute of Technology, Philippines

Mildred Vanessa Lopez Cabrera
Tecnológico de Monterrey, Mexico

Rui Pedro Pereira de Almeida
University of Algarve, Portugal

IGI Global
PUBLISHER of TIMELY KNOWLEDGE

A volume in the Advances in Medical Education, Research, and Ethics (AMERE) Book Series

Table of Contents

Preface

Instructional technologies used to be optional and supplemental pedagogical tools until the global health crisis of 2020 compelled education systems to rely on digital devices and services to guarantee academic continuity (Almeida, 2022; Garcia, 2022; Lopez, 2022). Suddenly, the contemporary principles and practices utilized in delivering education curricula were insufficient and ineffective. In health education, the disruption of traditional in-person learning experiences created a host of new challenges. Several studies reported negative consequences (Connolly & Abdalla, 2022; Gadi et al., 2022; Wanigasooriya et al., 2021), including mental health burdens, limited access to resources, difficulty maintaining motivation, insufficient medical training, and more. Additionally, the pandemic has had a significant negative impact on healthcare professionals. Overburdened hospitals and clinics have placed a huge strain on the medical workforce, leading to burnout, stress, and mental health concerns among healthcare professionals (De Kock et al., 2021; Shreffler et al., 2020).

Despite these challenges, the COVID-19 pandemic served as a catalyst in the widespread adoption of instructional technologies (Dey et al., 2020; Garcia, 2023). This new education landscape highlighted the necessity for schools to be equipped with digital infrastructure, platforms, and tools. With remote and hybrid learning models becoming the norm, teachers and students alike have experienced the benefits of incorporating digital tools into their educational routines. Consequently, it has become difficult to imagine going back to the traditional methods of teaching in a post-COVID-19 world (Zhao & Watterston, 2021). Acknowledging the vital role of technology in shaping the future of education, there is now a greater demand to foster innovative interventions and continuous improvements in strategies, methodologies, and systems to empower learners, educators, and leaders in the digital age. This paradigm shift requires a fundamental transformation in the way we approach teaching and learning, and a willingness to embrace new approaches and tools that can enhance the quality of education and support student success. By leveraging the full potential of instructional technologies, we can provide students with the skills, knowledge, and competencies they need to succeed in a rapidly changing world.

Although the transformation has been profound, many questions remain unanswered regarding how to make this technology accessible to everyone. The disparities and lack of access to technology and other resources that were present before COVID-19 grew and complexities as many were left unemployed because of the recession. Therefore, the effort made by educators to provide low-cost and open solutions is more relevant than ever. Openly sharing practices with colleagues from other countries and regions might hold the key to finding feasible local solutions. The call raised by UNESCO to leave *no one behind* makes sense in this shared effort to provide quality education and quality of care with no discrimination for people with disabilities, regardless of gender, protecting displaced children and minorities. These challenges must still be part of the agenda of educators and health professionals.

ABOUT THIS BOOK

The book *Handbook of Research on Instructional Technologies in Health Education and Allied Disciplines* provides comprehensive coverage of innovative methods and strategies to produce the next generation of health professionals. It lays the groundwork for implementable teaching and learning models that facilitate knowledge acquisition, enhance perceptual variation, improve skill coordination, and develop a scientific and technological mindset. It is designed to provide an in-depth look at the latest advancements and best practices in the field, with a specific emphasis on improving student learning outcomes and professional development. Each chapter provides an in-depth examination of instructional technologies, including artificial intelligence (AI), machine learning, gamification, telemedicine, chatbots, virtual and augmented realities, bioprinting, computer-assisted instruction (CAI), mobile health, smart learning environments, intelligent tutoring systems (ITS), and more. In addition, these chapters illustrate how these educational technologies can be effectively developed and implemented in real-world settings that are contextualized in various medical and health domains, including nursing, physiotherapy, radiology, neurophysiology, physical health, dentistry, clinical medicine, and more.

The book is a must-read for all stakeholders in health education and related fields, including educators, students, researchers, administrators, and healthcare professionals. For educators, this book provides a wealth of information on the latest instructional technologies and strategies, along with guidance on how to effectively integrate these tools into their curricula. For students, the book offers an understanding of the technologies and tools that are shaping the future of health education and provides a roadmap for success in the digital age. For researchers, the book inspires new research directions and helps researchers stay up to date with the latest developments and trends in the field. For administrators, the book can be used to guide decision-making on technology adoption and integration, and to develop and implement effective technology-based programs and initiatives. For healthcare professionals, the book provides a deeper understanding of the role that technology plays in health education and how it can be leveraged to improve patient outcomes. With its focus on the intersection of technology and health education, the book is also a valuable resource for anyone who is looking to stay ahead of the curve in an ever-evolving healthcare industry and health education. The contributors to this book are experts in their respective fields, bringing together a wealth of expertise and experience from the health education and technology domains. They are a team of 50 authors from diverse countries, including the Philippines, Canada, Finland, Egypt, India, Portugal, Indonesia, Turkey, Malaysia, South Africa, and the United Arab Emirates. These authors have come together to share their knowledge, insights, and research, providing a comprehensive and cutting-edge resource for anyone interested in the intersection of health education and technology.

This book is organized into 15 chapters, divided into two sections: "Entering the New Era of Digital Health Education" and "Instructional Technologies for Health and Allied Sciences." The first section is composed of seven chapters, which explore the transformation of healthcare education in the digital age. The section highlights the shift from traditional classroom-based learning to online and technology-enhanced methods of teaching and learning in the field of health sciences. The importance of this section lies in the recognition that digital health education is no longer a luxury, but a necessity in an ever-evolving healthcare landscape, where technology plays a crucial role in both patient care and professional development. This section provides insights and guidance for individuals, institutions, and policymakers looking to harness the full potential of digital health education. The second section is composed of eight chapters, which focus on the use of various technology-based tools and methods for teaching and learning in the fields of health and allied sciences. The section highlights the range of

instructional technologies and how they can be leveraged to improve the quality of health education. The importance of this section lies in its examination of how instructional technologies can support student learning and engagement, enhance the quality of teaching and assessment, and facilitate the development of competencies required for successful practice in the health and allied sciences. This section provides practical guidance for educators, instructional designers, and technology specialists seeking to leverage the full potential of instructional technologies in health and allied sciences education. A brief description including the key themes, concepts, and topics covered in each chapter from these sections are as follows:

Chapter 1 explores how health education must be transformed in the wake of the COVID-19 pandemic. It discusses the challenges posed by the pandemic, including the need for remote and online learning, and the importance of incorporating digital technologies into health education curricula. Furthermore, it guides how to effectively integrate digital technologies into health education, including the selection of appropriate technologies, the development of pedagogical strategies that support student learning, and the assessment of student learning outcomes. By addressing the key issues and challenges facing health education in the post-pandemic world, this chapter provides insights and guidance to take advantage of the opportunities offered by digital technologies in improving the quality of health education.

Chapter 2 offers a comprehensive overview of the use of educational technologies in physiotherapy education. It explores the latest advancements in digital technologies, including virtual reality, simulation, and mobile learning, and provides a roadmap for allied health educators looking to incorporate these technologies into their curricula. In addition, it emphasizes the importance of choosing the right technologies, aligning them with educational goals, and effectively integrating them into the teaching and learning process. By providing a roadmap for the integration of educational technologies in physiotherapy education as well as related health sciences, this chapter is an essential resource for anyone looking to enhance the quality and effectiveness of physiotherapy education in the digital era.

Chapter 3 investigates the use of information and communications technology (ICT) in health education through bibliometric and network analysis methods. It provides a comprehensive overview of the latest research and trends in the field, including a review of relevant literature, a bibliometric analysis of the frequency of ICT use in health education research, and a network analysis of the relationships between authors and institutions that have published on ICT use in health education. By providing a comprehensive overview of the current state of the field as well as how ICT has been used to support health education, this chapter is an important resource for anyone looking to understand the role of ICT in health education and to identify future directions for research and development in this area.

Chapter 4 yields a comprehensive overview of the use of artificial intelligence in teleradiology. It explores the latest advancements in AI and its applications in the field, including image analysis, diagnosis, and treatment planning. Moreover, it provides a rapid review of the educational and professional contributions of AI in teleradiology, including the development of new curricula, training programs, and clinical practices and their benefits, including increased accuracy and efficiency in diagnostic processes, improved patient outcomes, and increased access to care. By highlighting the benefits of using AI in teleradiology, this chapter is a vital resource for anyone looking to scrutinize the need for ongoing education and training and the potential for AI to augment, but not replace, the role of human healthcare professionals.

Chapter 5 examines the importance of continuous education and training for healthcare professionals in the context of digital technologies. It highlights the latest trends and developments in healthcare education and training, including the use of digital technologies to support lifelong learning. Further, it explores the challenges and limitations of using digital technologies for continuous education and train-

ing and the necessity for ongoing education and training for healthcare professionals. By assessing the benefits of using digital technologies to support continuous education and training, this chapter serves as an indispensable resource for increasing access to educational resources, improving learning outcomes, and enhancing the engagement of healthcare professionals in the learning process.

Chapter 6 scrutinizes the challenges and potentialities of using AI and telemedicine in neurophysiology. It provides a comprehensive overview of the latest trends and developments in the field, including the use of AI and telemedicine to support the diagnosis, treatment, and management of neurological conditions. Moreover, it highlights the benefits of using AI and telemedicine in neurophysiology, including improved patient outcomes, increased access to care, and reduced healthcare costs. This chapter is an important resource for anyone interested in the intersection of AI and telemedicine in neurophysiology, as it provides a comprehensive overview of the current state of the field, the benefits and limitations of AI and telemedicine use, and identifies future directions for research and development.

Chapter 7 provides an overview of the current state of 3D bioprinting technology and its applications in the field of medical science and tissue engineering. It offers an up-to-date overview of the latest advances in the field, including current research and development initiatives, and highlights the important role of education and training in helping to advance the use of 3D bioprinting technology in the medical profession. Moreover, it highlights the potential of 3D bioprinting to revolutionize the way medical professionals approach the diagnosis and treatment of various diseases, including those related to the circulatory system. This chapter is an essential resource for medical professionals, students, and researchers interested in learning more about the exciting possibilities of this cutting-edge technology applied in health education.

Chapter 8 assesses the effectiveness of using a CAI in teaching physical fitness and exercise in schools. It was conducted as a public health intervention, targeting school-aged students, and aimed to improve their physical fitness and overall health. In addition, it details the design and implementation of the application development and the intervention, including the use of CAI to deliver lessons on physical fitness and exercise as well as the outcome measures used to assess the impact of the intervention on students' physical fitness and health. The results of this research demonstrate the feasibility of using CAI to deliver effective physical fitness education, emphasize the importance of incorporating new technologies and pedagogies into health education programs and provide a roadmap for future research in this field.

Chapter 9 investigates the use of Kahoot! gamification as an instructional technology in nursing education, particularly in the promotion of student-centered learning and the development of critical thinking skills. It uses a socio-material perspective to examine the subjectivities of nursing lecturers who incorporate Kahoot! into their teaching practice. Likewise, it highlights the various ways in which Kahoot! has transformed nursing education, including the creation of engaging and interactive learning environments, the promotion of student-centered learning, and the development of critical thinking skills. The chapter provides valuable insights into the potential of gamification as an instructional technology and how it can be used to support student-centered learning and the development of critical thinking skills.

Chapter 10 reports on an experimental research project that aimed to develop and evaluate a mobile health application for pulmonary rehabilitation in patients with mild to moderate COVID-19 pneumonia. It involved two groups of patients - an experimental group that used the mobile app for rehabilitation and a control group that received traditional rehabilitation. The results of the study highlight the potential of mobile health applications as effective tools for pulmonary rehabilitation and demonstrate the importance of incorporating digital health technologies into healthcare delivery. This chapter contributes to a grow-

ing body of evidence that supports the integration of digital health technologies into healthcare delivery, as a means of improving patient outcomes and advancing the field of health education.

Chapter 11 explores the potential of smart learning environments in transforming dental education for Generation Z learners. It focuses on how these technologies can be used to enhance the learning experience for dental students and improve the effectiveness of dental education. This chapter argues that this type of learning environment provides several advantages over traditional teaching methods, including increased student engagement, improved learning outcomes, and a more efficient and effective learning process. The results reported in this chapter support the growing trend of incorporating smart learning environments into healthcare education and highlight the importance of embracing digital technologies in improving the quality of education delivered to future generations of dental professionals.

Chapter 12 scrutinizes the use of an ITS as an instructional technology for teaching basic nutrition concepts. It describes the development of a nutrition ITS following the K-12 Health Curriculum Guide by the Department of Education and its evaluation using an exploratory sequential mixed method. The results of the chapter provide evidence for the effectiveness of using ITS in healthcare education and suggest that ITS can be used to enhance the learning experience of students and improve the outcomes of healthcare education. By investigating the effectiveness of using ITS in teaching basic nutrition concepts, this chapter serves as a vital resource for anyone looking to enhance the quality of nutrition education and to help teachers educate children in making smart food choices and healthy eating habits.

Chapter 13 outlines the design and development of a chatbot using deep belief network technology following a review of the ethical, moral, security, and technical problems in this field. It also discusses the advantages of using conversational chatbot technology for healthcare applications, such as improved patient engagement and increased efficiency in handling routine inquiries. This chapter details the design process, including the analysis of different machine learning algorithms, the selection of relevant data sets, and the development of a chatbot architecture. By highlighting the potential of chatbots in transforming the healthcare industry, this chapter sheds light on the importance of AI-powered chatbots and how they can enhance the delivery of healthcare services, improve patient outcomes, and offer personalized care.

Chapter 14 highlights the growing concern surrounding the ethical considerations of using AI technologies in the field of education. It focuses on the importance of following ethical standards to ensure the responsible use of AI technologies in teaching and learning. The chapter aims to raise awareness of the importance of developing a guideline that promotes ethical standards and protects the privacy of students and teachers while using AI technologies in the teaching and learning process. It also emphasizes the need for teachers and educational institutions to be aware of the potential ethical challenges and to take necessary measures to address them. The chapter concludes by highlighting the importance of integrating ethical considerations into the design and deployment of AI technologies in education.

Chapter 15 focuses on the development of a machine learning algorithm designed to predict cardiac arrest. It provides a comprehensive analysis of their findings and implies how this technology can be utilized in the field of health education. The chapter opens a discussion on the importance of educating future healthcare professionals in terms of using machine learning algorithms and how they can be leveraged to enhance patient care. It also provides a visual analysis of the prediction results, demonstrating the potential of this technology in the early detection and prevention of cardiac arrests. The chapter also emphasizes the significance of incorporating advanced technologies, such as machine learning, into health education curricula to keep healthcare professionals up to date with the latest advancements in their field.

HEALTH EDUCATION IN THE MODERN AGE

The future of health education is rapidly evolving with the advent of digital technologies. The COVID-19 pandemic has accelerated the adoption of instructional technologies (Fung et al., 2022), making them a necessary tool for academic continuity. With this shift, health education is poised to enter a new era of innovation and transformation. Digital technologies offer new opportunities for health education to be more engaging, interactive, and personalized for students (Budd et al., 2020; Kuwabara et al., 2019; Stark et al., 2022). They can access a wide range of resources, multimedia content, and opportunities for collaboration and communication. This new landscape of learning will not only meet the needs of digital natives but also improve their academic outcomes. Teachers and educators also stand to benefit from these technologies. They can leverage them to enhance their teaching and assessment practices, improve the delivery of health education curricula, and provide students with access to rich multimedia content and educational resources. For example, they can use data analytics and machine learning algorithms to personalize their instruction and assess student progress.

In this digital age, health education must embrace technology and leverage it to create new learning opportunities. However, it is also important to ensure that these technologies are used ethically and responsibly and to educate students about their rights and responsibilities when it comes to the use of technology in health education. Furthermore, it is crucial to address the digital divide that continues to persist and to ensure that all students, regardless of their socioeconomic status, have access to the resources and technologies necessary for success. This includes providing access to digital devices, internet connectivity, and technical support. In conclusion, the future of health education in the digital age is both exciting and challenging. With the use of technology, health education can provide students with engaging, interactive, and personalized learning experiences, while also improving teacher and educator practices. Nevertheless, it is essential to ensure that these technologies are used ethically and responsibly and that students have access to the resources necessary to succeed.

In conclusion, the landscape of health education has undergone a significant transformation in recent years, largely due to advancements in technology and the integration of digital tools into the curriculum. With the global health crisis of 2020, the importance of instructional technologies has become increasingly evident as it provides a means for academic continuity. In the modern age, health education must continue to evolve and adopt new technologies to meet the needs of students, educators, and healthcare professionals. The integration of these technologies has the potential to enhance engagement, personalization, and access to resources, ultimately leading to better student outcomes. As we move forward, it will be crucial for all stakeholders in health education to embrace these technological advancements and continuously strive for improvement in the delivery of health education.

Manuel B. Garcia
FEU Institute of Technology, Philippines

Mildred Vanessa Lopez Cabrera
Tecnologico de Monterrey, Mexico

Rui Pedro Pereira de Almeida
University of Algarve, Portugal

REFERENCES

Almeida, R. P. P. (Ed.). (2022). *Handbook of Research on Improving Allied Health Professions Education: Advancing Clinical Training and Interdisciplinary Translational Research*. IGI Global. doi:10.4018/978-1-7998-9578-7

Budd, J., Miller, B. S., Manning, E. M., Lampos, V., Zhuang, M., Edelstein, M., Rees, G., Emery, V. C., Stevens, M. M., Keegan, N., Short, M. J., Pillay, D., Manley, E., Cox, I. J., Heymann, D., Johnson, A. M., & McKendry, R. A. (2020). Digital Technologies in the Public-Health Response to COVID-19. *Nature Medicine*, *26*(8), 1183–1192. doi:10.103841591-020-1011-4 PMID:32770165

Connolly, N., & Abdalla, M. E. (2022). Impact of COVID-19 on medical education in different income countries: A scoping review of the literature. *Medical Education Online*, *27*(1), 1–20. doi:10.1080/10872981.2022.2040192 PMID:35317712

De Kock, J. H., Latham, H. A., Leslie, S. J., Grindle, M., Munoz, S.-A., Ellis, L., Polson, R., & O'Malley, C. M. (2021). A Rapid Review of the Impact of COVID-19 on the Mental Health of Healthcare Workers: Implications for Supporting Psychological Well-being. *BMC Public Health*, *21*(1), 1–18. doi:10.118612889-020-10070-3 PMID:33422039

Dey, B. L., Al-Karaghouli, W., & Muhammad, S. S. (2020). Adoption, Adaptation, Use and Impact of Information Systems during Pandemic Time and Beyond: Research and Managerial Implications. *Information Systems Management*, *37*(4), 298–302. doi:10.1080/10580530.2020.1820632

Fung, C. Y., Su, S. I., Perry, E. J., & Garcia, M. B. (2022). Development of a Socioeconomic Inclusive Assessment Framework for Online Learning in Higher Education. In M. B. Garcia (Ed.), *Socioeconomic Inclusion During an Era of Online Education* (pp. 23–46). IGI Global. doi:10.4018/978-1-6684-4364-4.ch002

Gadi, N., Saleh, S., Johnson, J.-A., & Trinidade, A. (2022). The Impact of the COVID-19 Pandemic on the Lifestyle and Behaviours, Mental Health and Education of Students Studying Healthcare-related Courses at a British University. *BMC Medical Education*, *22*(1), 1–9. doi:10.118612909-022-03179-z PMID:35189863

Garcia, M. B. (Ed.). (2022). *Socioeconomic Inclusion During an Era of Online Education*. IGI Global. doi:10.4018/978-1-6684-4364-4

Garcia, M. B. (2023). Factors Affecting Adoption Intention of Productivity Software Applications Among Teachers: A Structural Equation Modeling Investigation. *International Journal of Human-Computer Interaction*, 1–14. Advance online publication. doi:10.1080/10447318.2022.2163565

Kuwabara, A., Su, S., & Krauss, J. (2019). Utilizing Digital Health Technologies for Patient Education in Lifestyle Medicine. *American Journal of Lifestyle Medicine*, *14*(2), 137–142. doi:10.1177/1559827619892547 PMID:32231478

Lopez, M. (Ed.). (2022). *Advancing Health Education With Telemedicine*. IGI Global. doi:10.4018/978-1-7998-8783-6

Shreffler, J., Petrey, J., & Huecker, M. (2020). The Impact of COVID-19 on Healthcare Worker Wellness: A Scoping Review. *The Western Journal of Emergency Medicine*, *21*(5), 1059–1066. doi:10.5811/westjem.2020.7.48684 PMID:32970555

Stark, A. L., Geukes, C., & Dockweiler, C. (2022). Digital Health Promotion and Prevention in Settings: Scoping Review. *Journal of Medical Internet Research*, *24*(1), 1–25. doi:10.2196/21063 PMID:35089140

Wanigasooriya, K., Beedham, W., Laloo, R., Karri, R. S., Darr, A., Layton, G. R., Logan, P., Tan, Y., Mittapalli, D., Patel, T., Mishra, V. D., Odeh, O., Prakash, S., Elnoamany, S., Peddinti, S. R., Daketsey, E. A., Gadgil, S., Bouhuwaish, A. E. M., Ozair, A., ... Collaborative, T. M. S. (2021). The Perceived Impact of the COVID-19 Pandemic on Medical Student Education and Training – An International Survey. *BMC Medical Education*, *21*(1), 1–8. doi:10.118612909-021-02983-3 PMID:33388043

Zhao, Y., & Watterston, J. (2021). The Changes We Need: Education Post COVID-19. *Journal of Educational Change*, *22*(1), 3–12. doi:10.100710833-021-09417-3

Handbook of Research on

Instructional Technologies in Health Education and Allied Disciplines

Instructional technologies used to be optional and supplemental pedagogical tools until the global health crisis of 2020 compelled education systems to rely on digital devices and services to guarantee academic continuity. Suddenly, the contemporary principles and practices utilized in delivering health education curricula were insufficient and ineffective. Acknowledging the vital role of technology in shaping the future of education, there is now a greater demand to foster innovative interventions and continuous improvement in strategies, methodologies, and systems to empower learners, educators, and leaders in the digital age.

The **Handbook of Research on Instructional Technologies in Health Education and Allied Disciplines** provides comprehensive coverage of innovative methods and strategies to produce the next generation of health professionals. The book lays the groundwork for an implementable teaching and learning model that facilitates basic knowledge acquisition, enhances perceptual variation, improves skill coordination, and develops a scientific and technological mindset. Covering key topics such as gamification, telehealth, and robotics, this reference work is ideal for healthcare professionals, nurses, administrators, researchers, academicians, scholars, practitioners, instructors, and students.

Topics Covered

- Artificial Intelligence
- Augmented Reality
- Computer Software
- Digital Games
- Gamification
- Health Education
- Personalized Learning
- Robotics
- Telehealth
- Virtual Reality
- Wearable Devices

IGI Global
PUBLISHER of TIMELY KNOWLEDGE

701 E. Chocolate Avenue
Hershey, PA 17033, USA
www.igi-global.com

ISBN 978-1-6684-7164-7