# Digital Frontiers: Harnessing Technology to Enhance Healthcare Safety Training and Education

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## Abstract

In the era of digitalization, technology continues to develop rapidly across various sectors, one of which is the health sector. The emergence of digital innovation today has brought very significant changes in improving the quality of education and training for prospective health workers. This study aims to analyze how effective technology is in supporting the transformation of learning and training conducted by prospective health workers. The method used is a quantitative and qualitative approach based on the level of agreement in an ordinal manner as well as open responses or opinions from various respondents through a survey that has been reviewed so that the survey is relevant based on the discussion topic. Our respondents are students from the Faculty of Health Sciences at a university located in South Jakarta. This survey aims to find out students' views regarding the implementation and utilization of technology in the health sector. The results of the study show that digital technology can help students understand health learning and training more efficiently. This simultaneously encourages them to participate actively in community activities. Behind this, the role of health workers continues to develop to provide safe and comfortable services as well as to seek support from collaborative professional practices in their field. Thus, this innovation can continue to shape changes to realize the effectiveness, integrity, and efficiency of health workers in supporting education and training in the health sector. In addition, digital technology also enables the creation of more flexible, collaborative, and sustainable learning systems.

**Keywords:** digital technology, healthcare innovation, education, public health, healthcare service

## Introduction

According to *World Health Organization* (WHO), digital technologies can improve patient safety and quality of care, including through the development and implementation of health information systems (1). Moreover, work by Bates, *et al.*, 2018 demonstrates that applying digital technology (e.g., electronic medical records), can eliminate medical errors and enhance the efficiency of health services (2). Hence incorporation of digital technology in healthcare can be a novel preventive modality to improve safety and health education. Health technology refers to health information technology, medical devices and care technology systems with the potential to impact on patient diagnostic outcomes, care processes and patient safety (3). Furthermore, the education system continuous to evolve over time in accordance with changes in society and modern healthcare demands. This is very important to support and develop professional health personnel, including enhancing information for professional training in health (4).

In the current era of digitalization, there are various significant influences of technology in the health sector, such as having adequate digital infrastructure, advances in data processing and analysis (Big Data and AI), interoperability between health information systems, as well as government support through regulations/policies. In addition, active involvement of healthcare workers, readiness of educational institutions, and availability of technology to the community are also important factors supporting the broad and strong adoption of technology at the national level in a modern health (5). The evolution of digital technology and innovation has also led to transformation in various sectors, one of which is the health sector. The development of digital technology can also support the formation of a more flexible, collaborative, and sustainable learning system. As technology develops, there will be various options that can be used to eliminate the risk of work accidents and illnesses, as well as improve workers' welfare by increasing productivity. Furthermore, there is a significant impact of technology on healthcare services. This can be observed particularly in better diagnosis regarding service effectiveness, ease of access health information, and innovative ways of learning in the medical and care sector (6).

For the reason, we conducted this study is to assess the impact of introducing digital technology for enhancing the patients' quality and improving education among healthcare professionals, especially for public health and safety. This study seeks to address the following questions: What are the main challenges of digital technology in public health services?. How do digital novelties facilitate collaborative work of health workers?. What are the ethical issues that have been raised from introducing digital technology to health education and health services promotion?.

## Material and Methods

### *Material*

This study was conducted using a questionnaire or survey created through Google Form and aimed at collecting information from respondents' answers. The questionnaire contains statements related to the use and implementation of technology in education and health training, where each respondent was asked to choose an answer between "agree" or "disagree," as well as one open ended question regarding the implementation of technology in the health field, asking them to provide their opinion on the questions presented. The research respondents consisted of 70 students from the Faculty of Health Sciences (FIKES) at Universitas Muhammadiyah Prof. DR. HAMKA (UHAMKA). These students included students from the Nutrition and Public Health Study Programs. Before this questionnaire could be widely used, we conducted a feasibility test with 1 to 10 students to ensure that the statements and questions presented were clear, relevant, and easily understood by the intended respondents.

### *Methods*

This study used a questionnaire approach by applying a mixed-methods design and combining qualitative and quantitative analyses. Quantitative analysis was obtained from the "agree" or "disagree" questions using frequency and percentage to observe the overall trend of respondents' answers. Meanwhile, qualitative analysis was obtained from the open ended questions by examining the responses or opinions aimed at obtaining a comprehensive picture of the effectiveness of technology implementation in the health field. The effectiveness of this survey was measured by the proportion of respondents expressing their agreement as well as their opinions regarding the benefits and aspects that still need attention and improvement in the implementation of technology in the health field. The sample selection of this study was conducted deliberately *(purposive sampling)* by choosing students who were knowledgeable and relevant to the topic of the study so that the research results would be more relevant or aligned with the objectives of the questionnaire and could be properly and responsibly justified.

## Result and Discussion

*Demographic data*

This survey was conducted to determine how far the respondents agree or disagree regarding the use of technology in the healthcare field. A total of 70 respondents participated in the survey. The respondents were from the student of Public Health (77.1%) and Nutrition (22.9%). More than 80% of the survey questions showed positive response patterns, indicating agreement with the use of technology as a tool for health and public safety education and training.

**Table 1.** Descriptive statistics of respondents

| **Demographic Variables** | **Subgroups** | **Frequency (N=70)** | **Percentage (100%)** |
|---|---|---|---|
| Gender | Male | 8 | 11.4% |
| | Female | 62 | 88.6% |
| Age | ≤ 18 | 4 | 5.7% |
| | 18 | 40 | 57.1% |
| | ≥ 18 | 26 | 37.1% |
| Major | Nutrition | 16 | 22.9% |
| | Public Health | 54 | 77.1% |
| Semester | 1 | 58 | 82.9% |
| | ≥ 1 | 12 | 17.1% |

The majority of respondents were approximately 18 years old (57.1%), with some respondents under 18 years (5.7%) and over 18 years (37.1%) [Table 1]. To ensure the accuracy of the obtained information, source and interpretation triangulation, as well as cross-review of the literature, were applied. This process aims to guarantee that the data used are accurate, consistent, and academically reliable.

*Digital health awareness*

Our survey shows that 10% of respondents are not very familiar with the concept of using technology in the healthcare field, and 11.4% still find it difficult to access digital training or healthcare modules. Regarding the daily use of digital health technology, 10% of respondents are unfamiliar with the use of doctor consultation applications as one of the digital health technology tools [Table 2]. Overall, respondents believe that the use of digital tools such as e-learning, mobile application, telemedicine, barcode system, and other provide benefits and positive impacts for healthcare professionals [Figure 1].

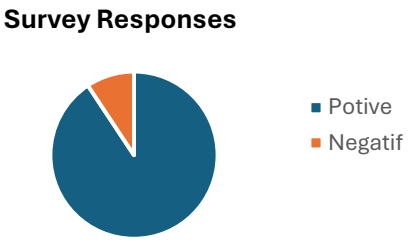


**Figure 1.** Respondents answers regarding the use and development if technology

*Digital health course needs*

Based on the survey result, the majority of respondents tend to prefer technological development that can assist them in accessing healthcare services, educational modules, training simulations, and other related resources. As many as 92.9% of respondents also find it easy to understand health information through digital media such as educational videos, application, or websites [Table 2]. Furthermore, more that 90% of respondents believe onto the healthcare system improves the quality of health care professional training.

The survey results show that all respondents (100%) agree on the importance of maintaining an open attitude towards the use of digital technology to prevent misunderstandings and support the education and training system for students or prospective healthcare workers. They also agree that use of e-learning, such as the OLU *(Campus Digital Learning)* platform, can facilitate healthcare students in accessing lecture materials and participating in training. This e-learning platform is considered capable of bridging learning needs across study programs in a flexible and efficient manner and is relevant to the demands of modern learning, which is creative and interactive. The same also occurred with a percentage of 100% regarding the optimistic of digital technology in the health sector. Based on this data, it shows that they have awareness and open attitude toward the preliminary step in advancement in the health sector. In addition, this level of agreement is most likely based on their direct experience in using platforms such ass mobile application, e-learning, social medial, and other forms technology, which allows them to directly feel the positive impact of technology [Table 2].

**Table 2.** Descriptive statistics of respondents

| **Variables** | **Percentage of responses to given statements** | |
|---|---|---|
| | **Agree** | **Disagree** |
| I am familiar with the concept of applying digital technology in the healthcare field. | 90% | 10% |

| | | |
|---|---|---|
| Digital health will become a major innovation in the future of healthcare. | 97.1% | 2.9% |
| The security of digital technology in healthcare is very important. | 98.6% | 1.4% |
| It is necessary to have optimism and a positive attitude toward the development of digital technology in healthcare. | 100% | 0% |
| I find it easy to access digital training or modules related to healthcare. | 88.6% | 11.4% |
| I am familiar with or have used digital-based healthcare services, such as doctor consultation applications. | 90% | 10% |
| The use of e-learning, such as the OLU (Campus Digital Learning) platform, as a form of technology utilization can facilitate healthcare students both from the Public Health and Nutrition programs in learning course materials and participating in training. | 100% | 0% |
| I find it easier to understand health information through digital media such as educational videos, application, or websites. | 92.9% | 7.1% |
| It is necessary to maintain an open attitude toward the use of digital technology to prevent misunderstandings while supporting the education and training of Public Health students. | 100% | 0% |

The survey results also show that around 11.4% respondents experienced difficulties in accessing learning materials on media platforms such as e-learning, health applications, etc. This reveals the fact that as users, they still face obstacles and challenges such as limited internet connectivity, lack of digital devices, and low digital literacy in using technology. Therefore, it is highly recommended that providers of healthcare training or education improve technological infrastructure, provide clear guidance, and ensure that materials are available in various formats to prevent unequal access for all students [Table 2].

*Respondents' feedback on the use of technology in the health sector*

Both respondent of students also showed different responses to each question. About 90% of Public Health students are familiar with digital health, while 83% of Nutrition student are familiar with digital health. In addition, about 79.6% of Public Health students agree with the use of digital health, where this percentage is lower compared to the agreement level of Nutrition students (95.5%). The comparison is also seen in the use of health apps, with Nutrition students having a higher percentage (98.4%) compared to Public Health students (84.8%). However, both groups of respondents have the same percentage in the utilization of e-learning as one of the digital technology applications in the health sector [Fig 2].

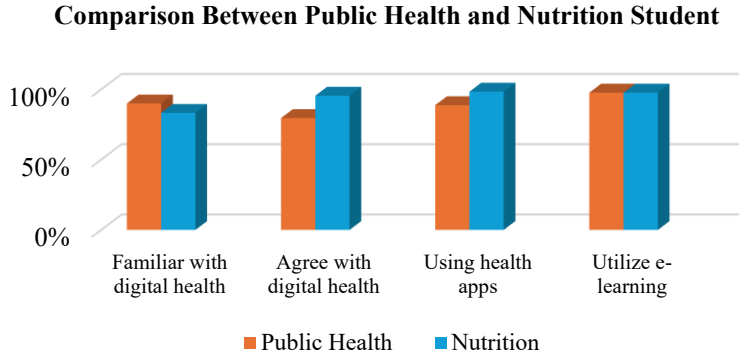


**Figure 2.** Comparison of public health and nutrition students

In addition, respondents highlighted that digital technology can contribute to improving the skills and readiness of healthcare workers, especially through simulation based training that replicates real life situations without endangering patients. This is regarded as highly important for enhancing the quality of care and patient safety. A few respondents also mentioned that with digitalization it is possible to enhance mobility between the latest news, speed up the learning curve and make health education equally reachable in every corner of one's country as well as globally.

But here is also a number of notes and challenges to contemplate when normalizing digital technology. A few respondents also mentioned that with digitalization, it is possible for the community to enhance mobility between the latest training and education transformations, accelerate the curve related to learning effectiveness, and make the health education and training system accessible evenly in every corner.

## *Discussion*

### *The main challenges of digital technology in public health services*

There are practical as well as technical barriers in the implementation of digital technology in public health services. The main barriers include the access gap in remote areas (3T), inadequate health infrastructure, and healthcare providers who may still have deficiencies and skills in using digital health technology (7). This gap impacts the uneven use of technology, which means that people in some regions cannot fully realize the benefits of technology in the health sector. Moreover, data privacy presents one of the key concerns as there is high risk in leaking health information which is confidential and personal (8). Another obstacle is the inadequacy of training for digital health professionals. Most health care workers are not trained well enough to use digital systems effectively and efficiently. Moreover the costly integration of technology constitutes a major obstacle for many healthcare organizations, particularly those with smaller budgets. This need for significant investment in new structures is one reason why it is important to strategically invest in digital public health and to have strategic support from the different actors involved.

### *Digital novelties facilitate collaborative work of health workers*

Collaborative practice among healthcare professionals can be supported through digital innovation, such as *Integrated Electronic Medical Record Systems* (EMR/EHR), mobile apps and team management tools, telemedicine and teleconsultation, collaborative platforms to share modules or research findings as well as provide professional development resources, such as websites, agglomerative big data use and health analytics (9). Mobile apps, including chat, video conferencing and task management tools, can support healthcare providers as they coordinate and communicate regarding cases anywhere and anytime for community health and safety. In addition, the use of collaborative tools such as training modules, AR/VR simulations and educational website/blogs enables training, learning and even professional coaching to be implemented in a better way (10).

Big data and health analytics are equally important, as they enable the aggregation of individual-level data for discussion by healthcare teams to guide clinical decisions, evaluate outcomes and plan services (11). Other systems such as EMR/HER allow healthcare providers from different departments to access personal data simultaneously making collaborative decision making more efficient. Furthermore, telemedicine and teleconsultation can facilitate healthcare professionals in remote and underserved areas (3T locations) to share diagnoses, treatment plans, and consultations even over long distances. This allows for decision making that is up to date and evidence based, enhances the quality of care for individual patients, maintains continuity of care as part of clinicians' and professionals' practice, while simultaneously improving professional development within and across healthcare teams.

*The ethical issues that have been raised from introducing digital technology to health education and training in public health*

Ethical considerations of the digital health technology application in health education and public health services are patient privacy, equitable access to education and information, healthcare professional integrity, transparency and accountability, quality of education and heath service (12). In this light, digital ethics becomes essential to develop responsible technology that adequately supports health care provision, education and training in such a way that it is fair, safe and trustworthy (13). When using digital technologies, including electronic medical records, mobile health applications, telemedicine and websites or other electronic tools, it is necessary to manage data securely so that personal information (or personal data) does not get into the wrong hands or misused as such. It will also be crucial to ensure equal access so all urban and rural communities have the same access to digital health technologies. It seeks to address inequalities in healthcare, education and training (14).

The choice of digital tools should also be framed by the prism of professional ethics such as to avoid making decisions solely based on AI systems and without sufficient human reflection (15). As such, the focus should be on transparency and accountability and Educations, as well as providers need to be transparency about how data or information can handled. This is also related to understanding what a system does, who is in charge, how decisions are made and so forth.

## Conclusion

In this study, it's explained that technological advances have brought many benefits, including telemedicine, data analysis, mobile app, and e-learning, which facilitate coordination among healthcare workers and make health related learning effective and efficient. However, several obstacles were also found, including technical and practical barriers, such as the access gap in remote areas (3T), lack of knowledge in utilizing technology, data privacy issues, as well as cost and support factors, which have led to many ethical issues today. Therefore, the need for a system of transparency, security, and accountability in every application of technology must be considered so that technology can be used correctly and appropriately.

This study has limitations because it's based on student's from one university. Therefore, in the future studies, it's recommended to expand the scope of respondents from multiple universities to obtain a boarder picture of technological changes in the health sector.

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