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Development of Android-Based Educational Media Application Related to Work Fatigue in Nurses

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Abstract

In this era, science and technology are advancing significantly. The development of information and communication technology, along with the emergence of mobile devices, can benefit the fields of education and healthcare through applications designed as educational media. Work fatigue among nurses is a condition that must be promptly addressed and cannot be ignored, as it can affect their job performance and has many negative consequences. The purpose of this research is to develop an educational media application related to work fatigue in nurses. This study is a Research and Development of an Android-based educational media application. Product testing was conducted by evaluating the validity of the educational media with content experts, media experts, and users (nurses). The results of the product testing showed that the content experts gave an average validity score of 92.86%, categorized as very valid, while the media experts rated it at 94%, also categorized as very valid. In a small-scale trial with 5 nurses, the application received a score of 93.7%, categorized as very good, though there were revisions needed regarding the ease of login. After revisions, a limited-scale trial with 10 nurses resulted in a score of 98.7%, categorized as very good. Thus, the developed educational media application on work fatigue for nurses is highly valid and can be effectively used by nurses independently on Android devices.

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INTRODUCTION

The availability of information technology has become a top priority in all aspects of life today. Research conducted in New York by Salway et al. (2020) When the COVID-19 pandemic surged, the public hospital system in New York City realized the need for innovative technological solutions to respond to the crisis. The rapid advancement of technologies such as social media, smartphones, and artificial intelligence has posed significant challenges for education practitioners to leverage these technologies in developing more advanced learning media (Haristiani, 2019). Traditional methods using paper are now considered ineffective in education due to limited access, outdated content, and poor graphics. Education through mobile-based applications is one of the alternative solutions (Ameri et al., 2020). In line with Encarnacion et al. (2021) who state that e-learning has significant potential to transform and advance traditional education, education can become more flexible, affordable, and accessible to anyone, anywhere.

The use of applications on mobile devices in education is referred to as mobile learning. Mobile learning is a subset of e-learning, utilizing electronic and digital devices that are portable. Mobile learning has the ability to distribute educational content in various media formats, such as videos, applications, slideshows, Word documents (Caraig et al., 2021). According to Trzebiński et al. (2020), the term *m-health* refers to smartphone applications and is increasingly being used in the healthcare sector. According to research by Abbaspur-Behbahani et al. (2022), it was concluded that mobile health (m-health) can have a positive impact on the health of the elderly. The use of m-health helps ensure the safety of the elderly and healthcare providers, accelerates the delivery of healthcare services, reduces service costs, and lowers the risk of illness and death during a pandemic.

Hospitals are an essential part of the healthcare system, operating daily and playing a significant role in improving public health (Inayatullah Kusuma & Hikmat Ramdan, 2023). One of the key human resources vital to the continuity of hospital services is nurses. Nursing staff represent the largest human resource in hospitals and have the longest interaction time with patients (Pusung et al., 2021). Nurses face a considerable workload, which includes the number of patient visits and the amount of nursing care that burdens them both physically and non-physically. The high workload experienced by nurses can lead to health issues, one of which is fatigue (Ferusgel et al., 2022). According to Weaver et al. (2024), shift work among nurses disrupts sleep patterns, resulting in inadequate rest. Consequently, nurses experience fatigue and decreased alertness, which affect their job performance, physical and mental health, and patient safety.

In the *Kamus Besar Bahasa Indonesia* (KBBI), the word *lelah* (fatigue) originates from *letih*, which means tired; weary; exhausted; sluggish; and lacking energy. The term *lelah* refers to both physical and mental conditions, but both lead to reduced work capacity and decreased bodily endurance (Suma'mur, 2020). Fatigue, according to Caldwell et al. (2019), is defined as a state of extreme tiredness, exhaustion, or drowsiness resulting from insufficient sleep, prolonged mental or physical work, or extended periods of stress or anxiety. Another definition of fatigue describes it as a warning that the body is experiencing a decline, either physically or psychologically (Lating & Sinta, 2022). According to Cahyani et al. (2024), work-related fatigue is a significant aspect that affects health and safety in the workplace; it is also recognized as having a negative impact on the quality of nursing care, patient satisfaction, and caregiver safety.

Nurse fatigue is a condition that cannot be ignored and must be addressed promptly, as it can affect nurses' job performance. This aligns with the study by Inayatullah Kusuma & Hikmat Ramdan (2023) which concluded that high levels of work fatigue can influence nurses' performance and their ability to deliver quality care. Nurses who experience fatigue may see a negative impact on their productivity and performance (Dewanti et al., 2022). Similarly, a study by Amelia et al. (2024)) found a significant relationship between work fatigue (p-value = 0.046) and the work productivity of female workers at Company X. Research by Handayani et al. (2023) also

concluded that there is a moderate correlation between work fatigue and work productivity among nurses at RSUD Talaud, indicating that the higher the work fatigue, the lower the work productivity.

According to Lembang et al. (2023), nurses are expected to make the best use of their rest time, manage their sleep schedules effectively, and engage in regular exercise for relaxation to minimize work-related fatigue. Night-shift nurses should adapt to nighttime schedules by using downtime to rest, helping reduce fatigue. During days off, engaging in refreshing activities is encouraged. Individual fatigue management is also necessary to prevent and reduce the severity of work fatigue complaints. Groves et al. (2020) emphasized that fatigue management should be part of hospital policy reviews, and providing education and training to nurses is essential to ensure both nurse and patient safety, as well as to support a positive work-life balance. This is in line with the study by Handayani & Hotmaria (2021), which found that implementing Occupational Health and Safety (OHS) counseling on fatigue management for nurses, along with meeting proper nutritional intake, is necessary as a preventive measure against more serious work-related illnesses.

The purpose of this study is to develop an educational application related to work fatigue in nurses.

METHOD

(1) Research Design

The type of research used in this study is Research and Development (R&D). The research and development method is a research approach used to produce a specific product. This study refers to the research procedures proposed by Borg and Gall (1983). Product development using this model has the advantage of producing outputs with a high level of feasibility and validity, as well as continuous innovation, meaning that the development of the product can be sustained over time.

The Borg and Gall development model consists of 10 stages, including: (1) research and information collecting, (2) planning, (3) developing a preliminary form of the product, (4) preliminary field testing, (5) main product revision, (6) field testing, (7) operational product revision, (8) operational field testing, (9) final product revision, and (10) dissemination and implementation. However, in this study, adjustments were made so that the process only reached the design validation stage. The results of this validation met the feasibility criteria for limited trial implementation. The development stages of the media in this study are as follows:

a. Data Collection and Research
b. Planning
c. Initial Product Development
d. Expert Validation
e. Small-Scale Trial
f. Product Revision
g. Limited-Scale Trial

(2) Data Sources

a. Primary Data
   The primary data in this study consists of questionnaire data from material and media expert validation, as well as nurse response data.
b. Secondary Data
   The secondary data in this study consists of data on the general overview of the hospital, the general profile of the research sample, and previous studies.

(3) Research Subjects

The subjects of this study are two material experts, who are lecturers in public health at UNNES, one media expert, and nurses. The object of the study is the educational application media based on Android.

(4) Research Instrument

The instrument used in this study is a questionnaire. The questionnaire data is derived from the validity results of the media expert team and the material expert team. Based on these descriptions, the researcher draws conclusions from the validation questionnaire results provided by the media expert team and the material expert team.
The evaluation of the developed product is also conducted by nurses as research subjects to determine their response to the development of the educational application media related to work fatigue and to assess the feasibility of the media product. The assessment results from the

questionnaires then serve as a reference for the researcher to improve the educational application media and reminder tool, with the aim of producing a better media product to be implemented directly to nurses and help manage work fatigue. The questionnaire sheet is developed based on the National Standards for Education (BSNP, 2014), adapted to fit the needs of this study.

RESULTS AND DISCUSSIONS

Results

This study produced an Android-based educational application. The development stages of this educational application are described as follows:

(1) Data Collection and Research

The initial stage was observation to assess the conditions in the field, including observing the work processes, the tools and materials used, as well as the challenges faced while working in the hospital. The purpose of these activities was to identify the potential issues and problems in order to find the appropriate solutions to address them. During the observation stage, it was found that many nurses experienced fatigue, dehydration, drowsiness, and often had trouble focusing while working. These problems faced by the nurses were symptoms of work fatigue.

The next stage was the collection of initial information regarding work fatigue and the incidence of workplace accidents among nurses in the hospital, which was obtained from the hospital's OHS department and previous studies.

Based on these issues, the researcher aimed to develop an Android-based educational application. This application is expected to help nurses gain knowledge about work fatigue and self-management strategies for controlling it, in an easy, fast, and accurate manner.

(2) Planning

Based on the initial information collected, the planning phase for designing the educational and reminder media will be carried out. This media will be developed as an Android-based application that meets the needs of nurses regarding work fatigue management. To serve its function as an educational tool and a reminder for controlling work fatigue, the application will be designed with attention to the practical and efficient aspects of work fatigue management. Specifically, this educational application will serve as a tool for nurses to improve their knowledge and control of work fatigue.

(3) Initial Product Development

The development of the initial product began with determining the name and logo of the application. The Android-based educational application was named "WorkSafe." After that, the content was selected, focusing on work fatigue and strategies for managing work fatigue among nurses. The WorkSafe application was developed to include educational material related to work fatigue and methods for managing it.

a. Initial Interface

The screen that appears when opening the application will be an introduction to the features available in the app.

Figure 1. Initial Interface

b. Main Menu Interface

The screen that appears after a successful login to the application will introduce the four main features of the educational app, which are:

"Education," "Stretching Videos," "Test," and "Stretching Alarm".

Figure 2. Main Menu Interface

c. Educational Feature and Stretching Video Feature Screens

In the "Education" feature, content related to work-related fatigue is presented, including the definition of work-related fatigue, symptoms, triggering factors, impacts, and control measures for work-related fatigue. In the "Stretching Videos" feature, one of the control measures for work-related fatigue is presented in more detail: a video guide on performing stretches during work breaks. This guide is based on guidelines from the Indonesian Ergonomics Association.

Figure 3. Education Feature

Figure 4. Stretching Exercise Video Feature

(4) Expert Validation

The design of the Android-based educational application media was then validated by media experts and learning material experts. The validation process consisted of two stages, namely:

a. Content Expert

The purpose is to test the accuracy of the content and various aspects related to the material. The content experts review the presentation of the material, including the curriculum (content standards), accuracy, sufficiency, and relevance of the material. In this study, the content validation was conducted by two experts.

Table 1. Validation by Content Experts

Assessment	Validation Score (%)
Validator 1	88,57%
Validator 2	97,14%
Averafe	92,86%

The validation results by two content experts indicate that the educational application is categorized as highly valid for use, with an average score of 92.86%. However, the validators provided comments and suggestions for revisions before the application can be officially used.

b. Media Expert

The purpose is to test the accuracy of the minimal standards in the development of media, as well as to assess the attractiveness and effectiveness of the media, and to review the choice of colors and design. In this study, the media validation was conducted by one expert.

Table 2. Validation by Media Expert

Assessment	Validation Score (%)
Validator 1	94%
Total	94%

The validation results from media experts indicate that the Android application is categorized as highly valid for use, with a total score of 94%. However, the validators provided comments and suggestions for revisions before the application can be officially used.

(5) Small-scale Testing

After the WorkSafe application has been validated by media experts and content experts, the product is then tested on a small scale with a sample of 5 nurses. Once the results of the small-scale trial and validation from several experts are obtained, the shortcomings of the product will be identified. After analyzing these shortcomings, the product will be revised to improve its feasibility, ensuring that its use aligns with expectations, ultimately resulting in a new product in the form of an Android-based educational and reminder application.

A small-scale trial was conducted with 5 nurses.

Table 3. The results of Small-Scale Trial

No	Question	Score (%)
1	The application can be operated easily and smoothly.	72%
2	Clarity of the presented material structure.	96%
3	Depth of the material presented.	96%
4	The text is readable clearly and well.	96%
5	The font size and type are legible.	92%
6	The color selection of the application is appealing.	92%
7	The suitability of video presentation.	100%
8	The audio is clear.	96%
9	The language used is simple and easy to understand.	92%
10	The app interface is appealing.	96%
11	Using this application enhances my knowledge.	96%
12	The application can be used anywhere and anytime (flexible).	100%
	Rata-rata	93,7%

The results of the small-scale trial showed that the educational application media falls into the "very good" category for use, with an average score of 93.7%. The assessment of each question was mostly dominated by the "Very Good" category, except for question number 1, which stated, "The application can be operated easily

and smoothly," and received a "Satisfactory" rating with a score of 72%. After conducting an observation with the five respondents (nurses), it was found that the application sometimes encountered issues, particularly during login.

(6) Product Revision

The results from the small-scale trial revealed that users encountered issues during the application login process. The next step is to make revisions to ensure that the application is easier for users to operate.

(7) Large-scale Testing

After the product design has been revised, the next step is to conduct a limited-scale trial of the product with nurses. In this study, the limited-scale trial was conducted with 10 nurses.

A limited-scale trial was conducted with 10 nurses.

Table 4. The results of Large-Scale Trial

No	Question	Score (%)
1	The application can be operated easily and smoothly.	96%
2	Clarity of the presented material structure.	100%
3	Depth of the material presented.	96%
4	The text is readable clearly and well.	100%
5	The font size and type are legible.	100%
6	The color selection of the application is appealing.	100%
7	The suitability of video presentation.	100%
8	The audio is clear.	100%
9	The language used is simple and easy to understand.	98%
10	The app interface is appealing.	96%
11	Using this application enhances my knowledge.	94%
12	The application can be used anywhere and anytime (flexible).	100%
	Rata-rata	93,7%

The results of the limited-scale trial conducted with 10 nurses show that the educational application is categorized as "very good" for use, with an average score of 98.3%. All questions were rated as "Very Good." This indicates that the educational application media has been functioning smoothly without any issues.

(8) Application Media Revision

Revisions to the educational application were made following feedback and suggestions from content experts and media experts who served as validators in this study. The table 5 presents a summary of the main changes made to the educational application.

Discussion

Fatigue is a natural signal from the body that occurs due to a decline in bodily functions from a good condition to a less favorable condition as a result of work processes. This natural signal can manifest as fatigue symptoms experienced by individuals, both physically and mentally (Carrieri et al., 2018). The factors causing fatigue are highly varied. The main significant factors contributing to work fatigue include age, gender, nutritional status, workload, and the body size of the worker (Oliffe et al., 2017). In addition, the work environment can influence work fatigue, such as noise, hot working conditions, poor lighting, and vibrations, which can lead to discomfort while working (Ozguc, 2021).

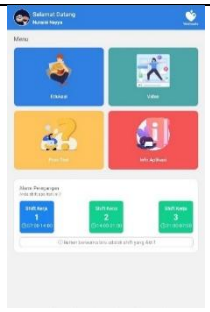
The feeling of fatigue is not only experienced after work, but also during work, and sometimes even before work. Fatigue that occurs continuously leads to chronic fatigue. Fatigue can be identified through symptoms or feelings that frequently arise, such as:

a. A heavy feeling in the head, feeling tired all over the body, heavy legs, yawning, confused thoughts, drowsiness, heavy eyes, stiffness and awkward movements, lack of balance while standing, and the urge to lie down.
b. Feeling difficulty in thinking, tired of talking, becoming nervous, unable to concentrate, lack of attention to things, tendency to forget, lack of self-confidence, anxious about something, unable to control behavior, and not diligent in work.
c. Headache, shoulder stiffness, back pain, feeling pressure in breathing, hoarseness, dizziness, eyelid spasms, tremors in limbs, and feeling unwell.

Work fatigue has become one of the critical issues that need to be addressed, as fatigue can lead to a loss of work competency, a decline in health, which can trigger workplace accidents, and a decrease in productivity and work performance (Verawati, 2017). According to the

Table 5. Application Media Revision

No	Revision	Initial Display	Post-Revised Display
1.	The work fatigue management content in the education feature was made more specific to make it easier to understand.		
2.	Stretching videos should use 2 models to show both front and back views		
3.	Adding the application logo to the main menu	—	
4.	The color of the shapes on the main menu screen should be changed to avoid a monotonous appearance		
5.	The shape size on the main menu screen can be extended to make it more proportional		

6. Icons Made More Attractive		

World Health Organization (WHO) in its health model made until 2020, it predicts that mental health issues, such as severe fatigue leading to depression, will become the second leading cause of death after heart disease.

Media commonly used for providing education related to occupational health and safety (OHS), particularly work fatigue, include leaflets, double-sided sheets, and audiovisual media (videos). These media are predominantly paper-based or disposable, which are less effective for use in today's information technology era. A more modern solution is transitioning to more advanced mobile applications (Wang et al., 2018). The use of applications as an educational medium has many advantages, such as easy access to information, which can be done anytime and anywhere.

This study has produced an Android-based educational application for nurses, which serves as an educational medium to improve nurses' knowledge about work fatigue and its management efforts, and is expected to reduce work fatigue rates. The choice of an Android application as a medium to solve the research problem is an innovation that suits the characteristics of the target group. One of the characteristics considered in this study is nurses.

This Android-based educational media contains content related to educational materials on work fatigue and its management efforts, as well as reminder alarms for nurses to perform stretching exercises as one of the management strategies. Through this application, it is hoped that nurses will become more aware of managing work fatigue independently, practically, and efficiently, allowing the application to be accessed anytime and anywhere.

One of the main features of this Android-based educational media is the Stretching Video. Stretching is an effort that can be made to manage fatigue in the workplace. It is a simple activity that can help the body feel better by relieving tension and muscle strength. Previous studies by Wahyu et al. (2020) concluded that Workplace Stretching Exercise has an impact on reducing work fatigue in workers. This happens because the intervention provides an opportunity for muscle relaxation or rest to prevent muscle tension. A study by Partawiguna et al. (2024) found a result with a value of ($p<0.05$) showing the average work fatigue before the intervention of stretching exercises was 59.53 with a standard deviation of 3.75, while the average work fatigue after the intervention was 35.06 with a standard deviation of 3.1. The difference in data was 24.46 with a standard deviation of 3.65. This indicates a reduction of 76.46%, with a confidence interval ranging from 23.15 to 25.78. The data was found to be significant with a value of ($p=0.000$). It was concluded that stretching exercises can reduce musculoskeletal disorders and work fatigue. This aligns with the findings of the research by de Vries et al. (2017) states that stretching exercises are necessary to provide benefits for workers, one of which is to reduce mental and physical fatigue. Similarly, a previous study by Estévez-López et al. (2021) concluded that stretching can reduce fatigue.

In addition, this Android-based educational media contains another important educational feature. The goal of providing education is to enhance understanding, which will eventually foster a positive attitude in addressing issues such as health problems (Nurhmasyah et al., 2015). Education is a self-

learning process aimed at honing and developing one's potential in order to achieve better learning and knowledge. This aligns with the research by Wonggom et al. (2020) which provided an intervention in the form of an educational application to heart failure patients, has proven to increase patients' knowledge. It was mentioned that the application was considered a fun and engaging way to deliver informational knowledge. Similarly, the study by Hikmah et al. (2022) which developed the Animiz application as a learning media for Arabic language for elementary school students. The results of this study showed an increase in students' interest in learning.

Occupational health and safety (OHS) has now become a priority for many countries around the world (Gendler & Prokhorova, 2021). According to academic literature, training and education are essential for improving Occupational Health and Safety (OHS) performance (Babalola et al., 2023). Duarte et al. (2021) stated that training and education, especially for less experienced workers, will improve OHS performance in the mining industry. In the study by (Handayani et al., 2023) the provision of education related to work fatigue given to caregivers at the Bhakti Asih Semarang Multiple Disabilities Orphanage (PACG) concluded that there was a 42% increase in respondents' knowledge level after the intervention.

CONCLUSION

Based on the results of the research and development of the educational application related to work-related fatigue in nurses, the process consists of 7 stages: data search and collection, application design, expert validation (content experts and media experts), small-scale trial, product revision, limited-scale trial, and application revision. This educational application related to work-related fatigue has met the eligibility criteria and is deemed valid by two content experts and one media expert. The nurses' responses to the educational application regarding work-related fatigue meet the "very good" criteria.

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