OMNI NURSING JOURNAL

QR Code-Based Educational Media as a Strategy to Improve Nursing Students' Knowledge of Pain Management

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Article info:
Received: 2025-08-10
Revised: 2025-08-21
Accepted: 2025-08-27

e-ISSN: 3047-6054
Volume 2(3): 70-76, August 2025

Abstract

Background: Pain management is one of the essential competencies that nursing students should possess. However, knowledge in this area remains suboptimal. One of the media that can be utilized to enhance education is the Quick Response (QR) Code, which enables quick, flexible, and repeated access to materials, thereby potentially improving students' understanding of pain management.
Objective: This study aimed to determine the effectiveness of QR Code–based educational media in improving nursing students' knowledge of pain management
Methods: This study employed a pre-experimental design with a pretest–posttest one-group approach. The sampling technique used was a total sampling technique, involving 25 respondents.
Results: The findings indicated that the effectiveness of QR Code–based educational media in improving nursing students' knowledge of pain management was mostly in the good category. However, despite having good knowledge, students still need improvement in practical skills and attitudes.
Conclusion: Nursing students' knowledge of pain management after receiving education through QR Code–based media falls into the good category. However, several aspects still need improvement, such as practical skills and professional attitudes, through training such as simulations and practice integrated into the nursing curriculum.

Keywords: Educational media; knowledge; nursing students; pain management; QR code

Introduction

Pain management is an integral part of nursing practice that must be mastered by every nursing student. According to the International Association for the Study of Pain (IASP), pain is an unpleasant sensory and emotional experience associated with, or resembling, actual or potential tissue damage. Pain involves a subjective perception aspect; therefore, pain is what the patient reports it to be.

Inadequate pain management can lead to various adverse effects, extending beyond mere discomfort. Prolonged pain may trigger both physical and psychological disturbances and affect multiple body systems, including the respiratory, cardiovascular, digestive, endocrine, and immune systems. In such situations, stress resulting from trauma experienced by the patient can further aggravate the pain. If this condition persists for an extended period, it may lead to emotional disorders such as depression and a sense of inability to carry out daily activities (Imelda Appulembang, 2015). Therefore, understanding and the ability to perform comprehensive pain assessment and interventions are essential competencies in nursing education.

However, a study conducted among final-year health students revealed that their knowledge of pain was still at low to moderate levels. The study also recommended providing training and learning opportunities in pain management before students enter the clinical stage (Wahyuni, Dewi, and Hartawan, 2023).

In today's digital era, learning strategies that leverage technology have become highly relevant, one of which is the use of Quick Response (QR) Code-based educational media, a simple yet innovative approach. QR Code-based educational media is an effective innovation that bridges the learning needs of millennials and Gen Z students. QR Codes can connect students to a variety of digital learning resources, such as educational videos, infographics, scientific articles, and interactive modules that can be accessed anytime and anywhere.

Quick Response (QR) Codes are now widely utilized in various fields, including education. As a learning medium, QR Codes allow students to access materials simply by scanning the barcode using a smartphone, eliminating the need to type long URLs. This technology supports efficient learning, is adaptive to technological advancements, and is centered on learners' needs. With QR Codes, learning becomes more modern, practical, and relevant to today's digital lifestyle (Handayani and Haryati, 2024). QR Code-based learning media can summarize complex information into content that is easy to access (Ar et al., 2022).

The implementation of QR Code-based educational media in nursing education remains relatively new and has not been extensively studied in Indonesia, particularly in the context of pain management. Therefore, it is important to examine the effectiveness of this medium in improving nursing students' knowledge through an evidence-based scientific approach. This study is expected to make a tangible contribution to the development of technology-based learning innovations that are efficient, flexible, and impactful in enhancing students' competencies in pain management.

Methods

Study Design

This study employed a pre-experimental design with a one-group pretest–posttest approach, in which knowledge was measured before and after the intervention using QR Code-based educational media.

Samples

The population of this study consisted of 30 sixth semester nursing students at STIKes Amanah Makassar. The sample was determined using a total sampling technique, however, only 25 students agreed to participate and completed the questionnaire. The inclusion criteria included: 1) Active sixth semester undergraduate nursing students; 2) Willing to participate as respondents; 3) Possessed a digital device (smartphone/tablet) capable of scanning QR Codes; 4) Had not previously attended training on pain management; 5) Able to use basic digital/technology tools, such as opening links and accessing educational materials. Meanwhile, the exclusion criteria were: 1) Did not complete either the pre-test or post-test questionnaire; 2) Experienced technical issues when accessing the educational media (e.g., unable to scan the QR Code or open the materials); 3) Were ill or on academic leave during the data collection period.

Instruments

The pain management knowledge questionnaire was developed by the researchers based on the Pain Management Guidelines and the SIKI nursing reference book. Content validity was assessed by two nursing experts, while reliability testing yielded a Cronbach's Alpha value of 0.732. It consisted of 15 dichotomous-scale questions. The components of the pain management questionnaire included: knowledge of pain assessment (items 1, 4, 9, 14), non-pharmacological approaches to pain management (items 2, 5, 7, 11, 12), health education and patient/family involvement (items 3, 10, 13), evaluation and follow-up of interventions (items 6, 15), and the role and collaboration of the healthcare team (item 8).

Interventions

The intervention consisted of an educational medium in the form of a QR Code–based digital module that contained materials on pain management, including definitions of pain, types of pain, pain scales, and both pharmacological and non-pharmacological approaches. During the intervention process, the researcher distributed the QR Code to participants in printed or digital format. Students were asked to scan the QR Code and learn the materials independently using their smartphones. Afterward, their knowledge was assessed through a post-test. Students were given three days to access and learn the materials independently.

Data Collection

Data were collected through a pre-test (before the intervention) and a post-test (after the intervention) using the same instrument. Both were conducted online via Google Forms. Data collection took place in July 2025 over seven days, which included the pre-test, the intervention via QR Code, and the post-test. The principal investigator was assisted by two research assistants. The principal researcher supervised the entire process, one assistant supported questionnaire distribution and provided technical assistance for QR Code use, and the other assistant ensured smooth implementation, adherence to the schedule, and compliance with research ethics.

Data Analysis

Data were analyzed quantitatively using the paired t-test to determine the differences in knowledge scores before and after the intervention. Statistical analysis was performed using SPSS software.

Ethical Considerations

This study received ethical approval from the Research and Community Service Institution (LPPM) of STIKes Amanah Makassar with research permit number No: 036/LPPM/STIKES_A/VII/2025. Before data collection, the researcher provided respondents with an explanation of the study's objectives, benefits, and procedures. Research permission was obtained through informed consent, ensuring that participation in this study was voluntary. All respondents were made aware of their rights as participants and provided their consent by consciously and willingly completing the questionnaire.

Results

There was a total of 25 respondents in this study. Based on Table 1, all respondents were within the age range of 18–24 years, classified as late adolescence, totaling 25 (100%) participants. The majority of respondents were female, accounting for 20 participants (80%).

Table 1. The Characteristics of the Respondents

Characteristics	Frequency (n)	Percentage (%)
Age		
18 – 24 Years	25	100
Gender		
Male	5	20
Female	20	80
Total	25	100

Table 2 showed that majority of respondents had moderate and poor levels of knowledge regarding pain management before the intervention using QR Code-based educational media, with 12 (48%) respondents each. The smallest proportion was respondents with good knowledge, totaling one respondent (4%). Furthermore, the majority of respondents had a good level of knowledge regarding pain management after the intervention using QR Code-based

educational media, with 14 respondents (56%). The smallest proportion was respondents with poor knowledge, totaling 1 respondent (4%).

Table 2. Knowledge Level about Pain Management

Knowledge Level	Frequency (n)	Percentage (%)
Pre-test		4
Good	1	
Moderate	12	48
Poor	12	48
Pre-test		
Good	14	56
Moderate	10	40
Total	1	4
Total	25	100

The effect of QR Code-based educational media as an educational strategy to improve nursing students' knowledge of pain management was analyzed. Before conducting the bivariate analysis, a normality test was performed on the intervention group data before and after the treatment. The normality test was conducted to determine the appropriate statistical test to be used. The results of the normality test using the Shapiro–Wilk test (n = 25 < 50). Table 3 depicted that the variable measuring knowledge of pain management met the assumption of normality (p-value > 0.05). Therefore, the parametric paired t-test was used for the paired data (pre-test and post-test)

Table 3. Normality Test

Variable	Pre/Post	p-value
Knowledge of pain management (normality)	Pre	0.104
	Post	0.205

*Shapiro–Wilk Test

Table 4 depicted that before the intervention using QR Code-based educational media, the respondents' mean score for pain management knowledge was 8.68, which was categorized as poor knowledge. After the intervention, the mean score increased to 11.52, which fell into the good knowledge category. This indicates an improvement in pain management knowledge of 2.84 points between the pretest and posttest.

Tabel 4. Pain Management Knowledge Before and After Intervention

Group	n	Mean	SD	Difference	P (t)
Pre-test	25	8.68	1.574	2.84	0.000*
Post-test	25	11.52	1.558		

*Paired t-test

The results of the parametric paired t-test showed that QR Code-based educational media had a statistically significant effect as an educational strategy to improve nursing students' knowledge of pain management, with a p-value of 0.000 (p < 0.05).

Discussion

This study aimed to evaluate the effectiveness of QR Code-based educational media in improving nursing students' knowledge of pain management. The results of the paired t-test showed a significant increase between the pre-test and post-test scores after the intervention, indicating that this educational medium can serve as an effective learning strategy in nursing education.

The increase in students' knowledge scores can be explained by several factors. First, the QR Code–based approach allows quick and flexible access to educational materials. Students are not limited by time or place when studying the content, enabling them to learn at their own pace and convenience. In today's educational landscape, such learning flexibility can enhance the effectiveness of the learning process by allowing students to access materials anytime and anywhere, and to adjust their study schedules according to other activities (Ruswandi et al., 2025).A Study by Ulfa and Dian Maharani (2024) reported that both students and lecturers could scan QR Codes using mobile devices, thereby improving laboratory efficiency because work instructions no longer relied on printed documents or verbal explanations. The study also noted additional benefits of QR Code–based learning media, including practicality, speed, and ease of use, which encourage students to become more independent in learning how to use tools (Ulfa and Dian Maharani, 2024). The ease of access provided by QR Codes also contributes to increased learning motivation. QR Codes are considered a simple yet effective innovation for bridging information between the real and digital worlds. Students can simply scan the code using their devices and be instantly directed to the learning materials. This makes the learning process more engaging and less monotonous, particularly for today's digital-native students. According to Ahmed et al. (2020), the use of QR Codes in nursing education can enhance active engagement, increase satisfaction with the learning process, and improve perceptions of learning outcomes. The study further recommended that nursing education institutions integrate digital technologies such as QR Codes to improve teaching quality. Similarly, Rihatno et al. (2023) found that QR Code–based media fosters students' interest in learning and supports digital adaptation, which is highly relevant to the challenges of globalization and digitalization in education.

Although this study demonstrated an improvement in knowledge, certain challenges emerged during the intervention. Some students experienced technical difficulties, such as problems scanning the QR Code, unstable internet connections, and limited data quotas. Zakir et al. (2025) also emphasized that improving students' academic abilities through digital literacy requires not only technical skills but also practical competencies, the ability to learn independently, and confidence in using digital tools. According to the researchers, technology-based interventions still require adequate digital infrastructure to ensure equitable benefits. Furthermore, enhancing students' digital literacy is essential so that they can independently and critically access, understand, and evaluate content.

The findings of this study also suggest that technology-based educational approaches such as QR Codes can be used as alternatives or complements to conventional teaching methods. In nursing education, where mastery of theoretical concepts and practical skills is essential, innovative educational media are needed to ensure that students are not passive recipients of information but instead actively construct their knowledge through digital learning experiences.

In the context of pain management, it is crucial for students to master theoretical knowledge before entering clinical practice. They need to understand fundamental concepts such as the types of pain, the physiological mechanisms of pain, pain assessment techniques, and both pharmacological and non-pharmacological interventions. Mankelow et al. (2022) emphasized the importance of increasing study time devoted to pain-related topics to ensure adequate mastery.

The educational media developed in this study covered all these aspects in a simple yet informative format. This was reflected in the significant increase in post-test scores, particularly in questions related to pain assessment techniques and non-pharmacological interventions such as relaxation therapy and compresses. These findings are consistent with Kinyon et al.,

(2023), who reported that QR Codes serve as an effective interactive tool to enhance student participation, strengthen engagement in the learning process, and make large classes more dynamic and interactive. QR Code-based media, when enriched with dynamic content such as demonstration videos, clinical instructions, or interactive quizzes, can be effectively applied in various educational settings, including nursing education.However, it should be noted that an increase in knowledge does not automatically translate into improved practical skills or attitudes. Therefore, future research should consider measuring other variables such as attitudes, clinical skills, or even the long-term outcomes of using QR Code–based educational media. Combining quantitative and qualitative methods could also provide a more comprehensive understanding of the medium's effectiveness.

QR Code-based educational media can serve as an additional and effective learning strategy to improve nursing students' knowledge of pain management. In the future, this medium could be further developed into an interactive application or integrated into a Learning Management System (LMS) to support ongoing nursing education.

Conclusion

Nursing students' knowledge of pain management after receiving QR code-based educational media was categorized as good. This indicates that the use of QR codes as an educational strategy is effective in improving students' understanding of the concepts and principles of pain management. However, there are still limitations in the areas of practical skills and the application of professional attitudes in pain management. Therefore, further efforts are needed, such as simulation-based training, case discussions, or the integration of pain management practice materials into the curriculum, to enhance students' ability to apply their knowledge accurately and effectively.

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