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Nursing Students' Perception on User-Centred Design in Developing Smartphone Applications for Self-Directed Learning of Clinical Skills

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Abstract:- The integration of mobile technology in education has opened opportunities for enhancing self-directed learning (SDL), particularly in nursing education, where clinical skill acquisition poses significant challenges. This study explores nursing students' perceptions of smartphone applications incorporating user-centred design (UCD) principles to support self-directed learning (SDL) of clinical skills. Sixteen undergraduate nursing students from a public university in Malaysia participated in in-depth interviews. Thematic analysis identified key subthemes: perceived convenience, mobility, content quality, ease of use, learnability, and organized interfaces. These UCD elements enhanced learning performance, improved usability, and supported integration into students' routines. The findings highlight the potential of UCD-driven applications to bridge the theory-practice gap, foster SDL, and enhance clinical education.

Keywords*: self-directed learning, smartphone applications, clinical skill education, user-centred design.*

1. Introduction

The integration of mobile technology into education has opened new avenues for enhancing self-directed learning (SDL). SDL is defined as "a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" [1]. In nursing education, SDL has been increasingly recognized as a critical strategy to promote autonomy and lifelong learning, especially in acquiring clinical skills.

User-centred design (UCD) principles, which prioritize the needs, preferences, and contexts of end-users in application development, have emerged as a crucial approach to enhancing the usability and effectiveness of educational technologies. By focusing on factors that can improve learning performance, UCD can facilitate SDL by ensuring that applications are accessible, engaging, and aligned with learners' needs [2]. These principles are especially relevant in nursing education, where clinical skills acquisition demands practical, efficient, and user-friendly learning tools.

The application of SDL in nursing is particularly relevant due to the dual demands of theoretical knowledge and hands-on skill acquisition. Nursing education combines sensory, motor, and cognitive processes, but challenges in clinical skill acquisition persist. Factors such as limited resources, overcrowded learning spaces, and the complexity of linking theoretical knowledge to practical applications hinder students' learning [3][4]. Moreover, the authenticity of the learning environment significantly influences skill competency. Environments lacking realism can exacerbate the theory-practice gap, reducing students' ability to apply their knowledge effectively in clinical settings [5][6].

The use of mobile technology, specifically smartphone applications, has emerged as a potential solution to address these challenges. Mobile apps can enhance learning performance by providing easily accessible, consistent, and engaging resources. For example, features such as virtual procedure checklists and interactive tutorials offer practical tools for students to bridge the gap between theory and practice. Additionally, the mobility and convenience of smartphone applications make them well-suited for self-directed clinical skill learning, allowing students to access resources anytime and anywhere [7]. These tools can also reduce cognitive load and foster motivation by simplifying complex tasks and enabling students to track their progress.

Organizational factors, such as curriculum design and the availability of resources, further shape SDL experiences. Limited time for skill practice and large student cohorts sharing the same learning space can create barriers to effective learning. Adequate resource allocation and structured learning environments are necessary to prepare students for real-world clinical scenarios [8]. Furthermore, supportive relationships with educators play a crucial role in fostering SDL. Collaborative educator-student interactions enhance motivation and help students set and achieve learning goals [9].

2. Objectives

Despite these advancements, limited research focuses on the integration of smartphone applications in SDL for nursing students, particularly in Malaysia. This study seeks to address this gap by examining the experiences of undergraduate nursing students with user-centred smartphone applications designed using low-fidelity paper-based prototypes. By incorporating paper-based prototypes during interviews, this research provides a deeper understanding of how nursing students interact with user-centred designs of the smartphone application for SDL of clinical skill learning.

3. Methods

This study employed a qualitative design to enable nursing students to share their experiences and perceptions regarding self-directed learning of clinical skill. Sixteen undergraduate nursing students from a public university in Malaysia participated in the study. Inclusion criteria included being actively enrolled, having completed at least one semester of clinical skill practice, and volunteering to participate. Participants were selected from four batches, with 4 students per batch. Semi-structured interviews were conducted using an interview guide focusing on learning performance and ease of use. Interviews were audio-recorded and transcribed verbatim. Thematic analysis was performed using NVivo 12, following Braun and Clarke's six-step framework. Inter-rater reliability was assessed with Cohen's Kappa coefficient, achieving a value of 0.80. Trustworthiness was ensured through reflexivity, peer validation, and iterative coding discussions. Expert reviewers evaluated the analysis process, enhancing the credibility and confirmability of the findings.

4. Results

This study presents findings from a detailed analysis of qualitative data, identifying key insights into how smartphone applications can enhance self-directed clinical skill learning among nursing students. The thematic analysis revealed patterns in participants' experiences, offering a comprehensive understanding of their perceptions and challenges. These findings shed light on the broader implications of integrating mobile technology into clinical education and set the stage for a discussion on the core themes that emerged from the data.

Theme 1: Learning Performance

Participants described a variety of ways in which smartphone applications enhanced their learning performance. This enhancement was reflected in several dimensions, including perceived convenience, mobility, and the quality of content provided by the applications.

Perceived Convenience

Applications saved time and provided immediate access to learning resources, fostering an environment where students could efficiently manage their study schedules while addressing real-time clinical questions. By offering instant access to a repository of procedures, guidelines, and tutorials, these applications eliminated delays that often occur when relying on traditional learning methods. Participants reported that this immediacy not only

facilitated a more productive learning experience but also enhanced their ability to respond promptly during clinical practice scenarios. Furthermore, the adaptability of smartphone applications enabled students to integrate learning seamlessly into their daily routines, making them particularly suited for the demanding and unpredictable schedules characteristic of nursing education.

"It saves time because once we have installed it, it is readily available. So once the lecturer asked [about a procedure], we suddenly feel the urge to search for it." (ID10, Y2S2)

Mobility

The ability to access learning materials anytime and anywhere was seen as a significant advantage, allowing students to incorporate study sessions flexibly into their daily routines. This accessibility reduced the dependency on traditional learning resources, which are often constrained by location and availability. Smartphone applications provided a platform for immediate reference during clinical scenarios, helping students bridge gaps between theoretical knowledge and practical application. Furthermore, participants highlighted how this mobility empowered them to review critical content during downtime, ensuring continuous learning and preparation for clinical tasks. The freedom to study in various settings not only increased convenience but also fostered a sense of control over their learning process, which is essential for self-directed learning.

"As for the smartphone, we will bring it everywhere we go… The tendency to open that app is really much higher than opening a book." (ID05, Y4)

Content Quality

Participants valued the inclusion of credible and consistent content tailored to their curriculum, emphasizing its importance in providing a reliable framework for learning. They noted that high-quality content ensured alignment with their academic goals, reduced confusion, and fostered confidence in using the application for self-directed learning:

"If everyone uses this app, we have the same guideline. If the lecturer also refers to this app, then we didn't have different guidelines." (ID13, Y2S1)

Theme 2: Ease of Use

Ease of use was another critical factor influencing adoption. Participants emphasized user-friendly designs, learnability and organized interface are significantly contributed to their willingness to engage with the applications

Easy to use

Applications resembling familiar tools like WhatsApp were preferred for their simplicity and ease of navigation. Participants noted that designs that mimic widely used apps reduced the learning curve and made the applications more accessible. For instance, one participant shared:

"No problem because easy to access … If the app similar to WhatsApp, then it's easy." (ID16, Y4)

Learnability

Participants also suggested that first-time users benefit significantly from step-by-step tutorials and clear instructions embedded within the application.

"For first-time users, it should guide step-by-step, like providing button 'NEXT', until they understand how to use the app. This way, it's clear for the newbies." (ID10, Y2S2)

These features were perceived as helpful in building confidence among less tech-savvy users. Participant 05, who admitted to having less interest in using the mobile application, claimed that there are still opportunities to learn by using this smartphone application. However, when compared to the other students, perhaps she needed more time to understand the system. The students explained:

"As for the usage of application in the smart phone, as for me, honestly, I will need time extra time, more than other people to learn, the application is all about." (ID05, Y4)

Organized Interface

A well-structured and organized interface was also highlighted as a crucial aspect of ease of use. Participants recommended categorizing content by academic year or topics to enhance accessibility. This structure, they explained, would enable users to quickly locate specific materials relevant to their current learning needs. One participant remarked:

"For this app, content should be arranged by topic… or by 'year of study'. At least when one needs to access a topic, it is easier to search." (ID03, Y3)

By addressing these aspects of design, the applications could cater to a diverse user base, accommodating both tech-savvy and less experienced users while ensuring an engaging and productive learning experience.

5. Discussion

The findings underscore the significance of user-centered design in enhancing learning performance. Mobility and perceived convenience were highlighted as critical advantages of smartphone applications, as they enable nursing students to access resources anytime and anywhere, consistent with findings by [10]. This accessibility fosters independence and reduces reliance on physical materials, which can be cumbersome and time-consuming [11].

Participants frequently mentioned how mobile apps can streamline learning processes by providing quick access to credible content [12]. For instance, many valued features such as procedure guidelines and built-in functionalities like timers and recording capabilities, which align with the practical demands of clinical skill learning. The emphasis on consistency across users and educators further highlights the potential of such apps to standardize learning experiences, ensuring equity in educational resources [13].

Ease of use was another pivotal factor. As noted, familiarity with existing applications like *WhatsApp* provided a baseline for intuitive interface design. The inclusion of step-by-step instructions for first-time users emerged as an essential feature to bridge initial usability gaps. This reflects [14], who argued that simple and navigable interfaces reduce cognitive load, making it easier for users to engage with new technologies.

The motivational aspects of mobile app adoption also emerged prominently. For Generation Y, characterized as technologically adept multitaskers [15], smartphone applications are seen as tools to boost efficiency and confidence in SDL. However, the need for thoughtful design is crucial to address variability in user familiarity and interest, as highlighted by one participant who required additional time to adapt to new applications.

In terms of broader implications, these findings reinforce the importance of designing applications that are not only functional but also tailored to the specific needs of nursing students. Features that integrate seamlessly into the clinical environment, such as procedure checklists and reflective recording tools, offer significant potential to enhance both learning outcomes and user satisfaction [16]. The role of technical and infrastructural support, such as reliable internet access, also cannot be overstated in ensuring the effectiveness of these tools in practice.

6. Conclusion

This study highlights the potential of smartphone applications to enhance self-directed learning (SDL) in clinical education. By prioritizing user-centred design elements such as intuitive interfaces, credible content, and accessibility, these applications can significantly impact learning performance. Features like procedure checklists and reflective tools were found to help students bridge the gap between theory and practice, fostering greater confidence and skill acquisition. The findings emphasize the importance of aligning application design with the specific needs of nursing students to maximize their engagement and effectiveness. Future research should focus on the implementation of these tools in clinical environments, their long-term impact on learning outcomes, and their potential to standardize educational resources across diverse settings.

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