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Development and Evaluation of an Android Mobile Application to Support E-Learning in Electrical Machine Courses

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ABSTRACT

The integration of mobile technology in higher education has transformed teaching and learning processes, particularly in engineering education. This study aimed to develop an Android mobile application to support e-learning in the Electrical Machine course and evaluate students' perceptions of its usefulness, ease of use, content quality, learning motivation, and overall satisfaction. A quantitative survey design was employed, utilizing convenience sampling to select 35 students from the Department of Electrical Engineering at Politeknik Mukah. Data were collected through a structured questionnaire distributed via Google Forms and analyzed using SPSS, with descriptive statistics and Cronbach's Alpha reliability analysis. Results revealed that students had very high agreement across all constructs, with mean values ranging from 4.89 to 5.00 and an overall Cronbach's Alpha of 0.94, indicating excellent reliability. The findings suggest that the developed Android mobile application effectively enhances learning experiences, motivation, and accessibility to course materials. Mobile learning technologies are thus effective supplementary tools in engineering education.

Keywords: *mobile learning, Android application, e-learning, electrical machines, engineering education*

INTRODUCTION

The rapid advancement of digital technologies has significantly transformed higher education, enabling students to access learning materials anytime and anywhere through mobile devices (Creswell & Creswell, 2018). Mobile learning (m-learning) enhances flexibility, accessibility, and engagement in learning (Li & Zhang, 2021). Smartphones are increasingly used by students to access multimedia learning resources, interactive exercises, and assessments outside the traditional classroom environment (Alrasheedi et al., 2020).

Engineering courses, particularly Electrical Machines, require students to grasp complex theoretical and practical concepts (Nguyen et al., 2022). Traditional lectures alone may not fully support understanding, so mobile learning applications can provide interactive and visual explanations to supplement learning (Park & Kim, 2023; Cheng et al., 2020).

Beyond their instructional role, digital learning media can also be viewed as an essential component of educational service delivery in higher education. Universities increasingly compete by providing high-quality learning experiences through innovative educational

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technologies that enhance accessibility, responsiveness, and student engagement. From a service management perspective, students are regarded as primary users of educational services, and their satisfaction is an important indicator of institutional quality. Consequently, the integration of mobile learning applications contributes not only to improved learning outcomes but also to enhanced perceived service quality and overall student satisfaction. Educational technologies that enhance service quality positively influence students' satisfaction and their overall learning experience (Ali et al., 2021).

Educational technologies also contribute to operational efficiency within higher education institutions by reducing dependency on printed materials, enabling faster dissemination of instructional resources, and supporting self-directed learning beyond classroom hours. From a management perspective, digital learning platforms improve resource utilization while allowing educators to deliver consistent instructional content more efficiently. Marketing and service management studies similarly argue that technology-enabled services enhance perceived value through improved service efficiency, responsiveness, and user experience, ultimately increasing customer satisfaction and organizational performance (Porter & Heppelmann, 2014; Vargo & Lusch, 2016; Kotler & Keller, 2022).

The Technology Acceptance Model (TAM) explains adoption of new technologies based on perceived usefulness and ease of use (Creswell & Creswell, 2018). Previous research shows that these factors, combined with content quality and learning motivation, strongly influence students' acceptance of mobile learning applications (Alrasheedi et al., 2020; Li & Zhang, 2021).

LITERATURE REVIEW

Mobile learning has been recognized as a transformative approach to teaching and learning, offering accessibility and flexibility that enhances student engagement (Creswell & Creswell, 2018; Nguyen et al., 2022). Recent studies highlight that mobile environments support personalized learning and collaborative activities, allowing students to interact with peers and instructors digitally (Hussain et al., 2021; Kaur & Kaur, 2022).

In engineering education, mobile applications facilitate interactive simulations, visualizations, and multimedia content that improve comprehension (Park & Kim, 2023; Cheng et al., 2020). Recent research indicates that such applications increase students' engagement, motivation, and academic performance (Nguyen et al., 2022; Santos et al., 2023). Moreover, these tools support flexible, self-paced learning, enabling repeated practice of technical exercises outside the classroom (Alrasheedi et al., 2020). Higher digital service quality leads to greater perceived value and user satisfaction (Sohn & Lee, 2022).

CONCEPTUAL FRAMEWORK

The conceptual framework (Figure 1) is based on TAM and mobile learning research. It examines how perceived usefulness, ease of use, and content quality influence learning motivation, which in turn affects overall satisfaction.

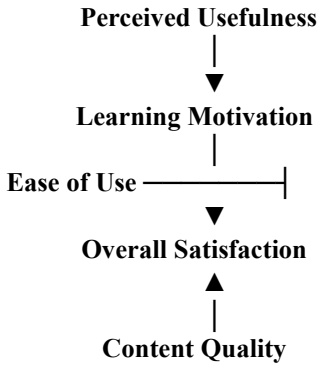


Figure 1: Conceptual Framework of Mobile Learning Application Adoption

Explanation:

- **Perceived Usefulness (PU)** – Students' belief that the mobile app improves learning performance.
- **Ease of Use (EOU)** – The extent to which the app is user-friendly.
- **Content Quality (CQ)** – Relevance, clarity, and organization of materials.
- **Learning Motivation (LM)** – Students' interest and engagement in the course.
- **Overall Satisfaction (OS)** – Students' satisfaction with the application as a learning tool.



Figure 2: Display layout - features buttons and notes display app

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METHODOLOGY

A quantitative survey research design was employed to gather insights into students' perceptions of the mobile application (Creswell & Creswell, 2018). The sample consisted of 35 students from the Department of Electrical Engineering at Politeknik Mukah, enrolled in the Electrical Machine course during the study period. Participants were selected using convenience sampling, a common approach in educational technology research to facilitate accessibility and timely data collection (Hussain et al., 2021; Kaur & Kaur, 2022). A structured questionnaire was distributed via Google Forms to assess students' perceptions across key constructs.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 1: Descriptive Statistics

Construct	Items	Mean	SD	Interpretation
Perceived Usefulness	6	4.94	0.25	Very High
Ease of Use	6	4.96	0.21	Very High
Content Quality	6	4.96	0.22	Very High
Learning Motivation	6	5.00	0.00	Very High
Overall Satisfaction	6	5.00	0.00	Very High

These results from the Table 1, indicate very high agreement across all constructs. Students reported that the app was easy to use, useful, and highly motivating, consistent with TAM predictions.

Reliability Analysis

Table 2: Reliability Analysis

Construct	Cronbach Alpha	Interpretation
Perceived Usefulness	0.91	Excellent
Ease of Use	0.92	Excellent
Content Quality	0.90	Excellent
Learning Motivation	0.95	Excellent
Overall Satisfaction	0.96	Excellent
Overall Instrument	0.94	Excellent

From the Table 2, the Cronbach Alpha values indicate excellent internal consistency, confirming the reliability of the instrument.

Discussion

The findings demonstrate that mobile learning applications can enhance students' understanding, motivation, and satisfaction in engineering courses (Kukulska-Hulme, 2020). High scores for perceived usefulness and ease of use align with TAM predictions and prior studies on mobile learning adoption. Content quality also played a critical role in influencing learning motivation and overall satisfaction (Zhang et al., 2020).

These results confirm that well-designed Android applications can serve as effective supplementary learning tools in technical subjects such as Electrical Machines, providing interactive, flexible, and self-paced learning opportunities. The effectiveness of digital learning environments depends on their usability, content quality, and the value they provide to learners (Almaiah et al., 2022).

Beyond improving learning outcomes, the Android application may also be considered a value-added educational service that enhances the quality of learning delivery within higher education. The exceptionally high satisfaction scores observed in this study indicate that students positively perceived the application not only as a learning aid but also as an efficient service platform that provided convenient access to instructional resources. Mobile learning applications improve accessibility, engagement, and students' overall learning experiences (Crompton et al., 2023). This finding is consistent with service quality theory, which suggests that technology-supported services improve perceived value, responsiveness, and user satisfaction. Furthermore, mobile learning contributes to institutional efficiency by reducing time constraints, facilitating continuous access to learning materials, and supporting independent learning, thereby improving both educational effectiveness and operational efficiency. Digital learning platforms have become essential educational services that improve accessibility, flexibility, and continuity of learning (Bond et al., 2021).

CONCLUSION

This study developed and evaluated an Android mobile application for e-learning in the Electrical Machine course. Students reported very high satisfaction, motivation, and perceived usefulness of the application. The findings suggest that mobile learning applications are effective tools to enhance learning in engineering education. Future research could explore gamification, simulations, and augmented reality features to further improve mobile learning effectiveness.

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