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PAPER

Enhancing Practicality of Web-Based Mobile Learning in Operating System Course: A Developmental Study

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ABSTRACT

Web-based Mobile Learning can enhance the learning experience in various educational contexts. However, in operating system courses, practical challenges arise when implementing a web-based mobile learning platform, which impacts the effectiveness and accessibility of learning materials for students. To overcome these challenges, this research and development (R&D) aims to improve the practicality of web-based mobile learning in operating system courses. The research adopts a systematic 4D (Define, Design, Develop, Disseminate) model to identify and explore strategies to optimize the practicality of the platform. Data collected from lecturers and students showed a high average value of practicality, 88.33% and 88.35%, respectively. This research contributes to improving the practical aspects of web-based mobile learning, thereby enhancing students' learning experience and outcomes in the context of operating system courses.

KEYWORDS

web-based mobile learning, practicality, operating system course, development

1 INTRODUCTION

Web-based mobile learning has emerged as a promising approach to enhancing learning experiences in diverse educational contexts [1], [2], [3]. With the widespread use of mobile devices and the internet, learners can access educational content conveniently anytime and anywhere [4], [5], [6]. However, practical challenges in implementing a web-based learning platform on mobile devices may arise in operating system courses. These challenges can hinder the effectiveness and accessibility of learning materials, impacting the overall learning experience for students [7], [8], [9]. Previous research has identified several barriers to implementing web-based learning on mobile devices in operating system courses, such as technical challenges, accessibility limitations, and limited interactivity [10], [11].

In operating systems courses, where students require hands-on practice and interactive learning experiences, ensuring the practicality of web-based mobile

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learning platforms is crucial [12], [13]. Effective integration of practicality considerations, such as usability, acceptability, and logistical factors, can significantly impact the overall success and adoption of web-based mobile learning in operating systems learning [14], [15], [16]. Therefore, this development research aims to overcome these challenges and specifically improve the practicality of web-based learning on mobile devices in the context of operating system courses.

In each stage of the development process, practical considerations will be carefully examined and integrated to create a more efficient and effective learning experience [17], [18]. Data will be collected through surveys, interviews, and observations to assess the practicality of the web-based mobile learning platform [19], [20]. Feedback from students and instructors, along with logistical analysis, will be analyzed to identify areas for improvement and provide valuable recommendations [21], [22], [23].

The findings of this study are expected to contribute to the current body of knowledge regarding the practical aspects of web-based mobile learning in operating system courses [24], [25], [26]. Instructors and instructional designers can benefit from the results of this research, as it will provide practical recommendations for optimizing web-based mobile learning platforms, ultimately leading to improved learning outcomes and empowering learners with the skills and knowledge needed in the digital era.

In conclusion, this development study focuses on improving the practicality of web-based mobile learning in operating system courses. Overcoming the practicality challenges and optimizing the web-based mobile learning platform in learning operating system installation is considered very good for improving learning effectiveness in the information technology education study program; on the other hand, this research also seeks to encourage motivation and better learning outcomes for students taking operating system courses. The results of this research can contribute to the advancement of Web-based Mobile Learning, promoting accessibility, engagement, and overall learning effectiveness in an educational context.

2 LITERATURE REVIEW

The development of mobile web-based learning, particularly in operating system courses, has significantly changed how students interact with learning materials. In this literature review, we aim to explore previous research related to practices in the context of operating system courses, with a particular focus on development research [27], [28]. One of the key aspects to consider in improving mobile web-based learning practices is the design and development of learning materials [29], [30]. Various studies have emphasized the importance of creating interactive and engaging content tailored to the specific needs of operating system courses [31], [32]. This involves incorporating multimedia elements such as videos, simulations, and interactive exercises to facilitate understanding and practical application of operating system concepts [33], [34].

Problems in teaching and learning in the context of operating system courses require interactive and immersive approaches, as well as hands-on practice to understand complex concepts [35], [36]. Therefore, ensuring that web-based learning platforms on mobile devices can provide an effective and practical learning experience for students in operating system courses is important [37], [38]. Previous research has also highlighted several barriers related to the implementation of web-based

learning on mobile devices in the context of operating system courses [39], [40]. These challenges can include accessibility limitations, lack of in-depth interactivity, and other technical issues [41]. Therefore, this development research aims to address these barriers and focuses on improving web-based learning practices on mobile devices, especially in the context of operating systems courses [42], [43].

This research will identify and explore strategies to optimize web-based learning practices on mobile devices in the context of operating system courses [44]. Through a systematic development approach, this research will cover the design, development, and implementation stages of web-based learning on mobile devices. Practical considerations, such as availability and feasibility, will be carefully considered to create a more efficient and effective learning experience [45], [46].

However, similar research focuses more on increasing the effectiveness of the learning media developed [47], so the practicality aspect of the media used by lecturers and students is considered very good to be studied to increase student motivation and learning outcomes. It is expected that this research can improve the practice of web-based mobile learning in operating system courses. By considering the design and development of learning materials, ensuring usability and user experience, using authentic assessment, and promoting collaborative and personalized learning experiences, teachers and learning designers can create effective and practical mobile web-based learning environments. Future research should focus on investigating the specific impact of various strategies and approaches to further improve the practice and effectiveness of mobile web-based learning with the research target being students taking operating system courses in the information technology education study program of the faculty of teacher training and education at Universitas Muhammadiyah Muara Bungo.

3 METHODOLOGY

3.1 Research design

The research conducted is Research and Development (R&D) focused on enhancing the practicality of web-based mobile learning in operating system courses. It follows the 4D model, a systematic framework consisting of four phases: Define, Design, Develop, and Disseminate [48]. The 4D model allows for iterative development, testing, and refinement of interventions, contributing to the advancement and practical application of web-based mobile learning in the operating system course.

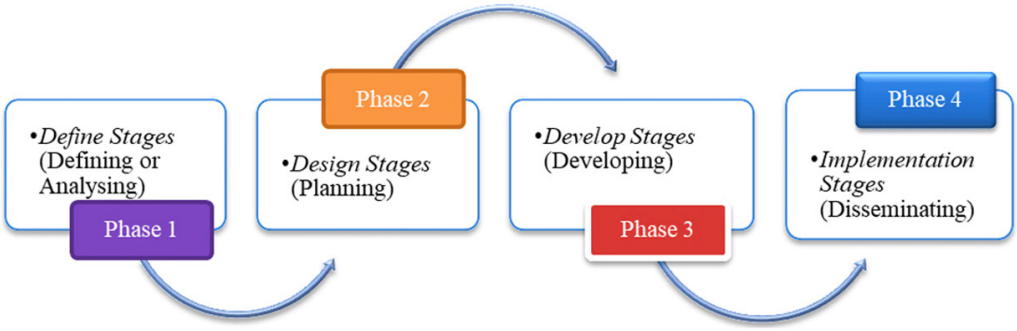

Fig. 1. Development procedure of web-based mobile learning

Define. In the Define stage, two main activities are carried out, namely observing, and examining the characteristics of the research population. Observation activities aim to gain an accurate understanding of real-life conditions, while the examination of population characteristics is important for determining the research sample to be included in the study. These activities are essential in providing clear guidance and setting the boundaries of the study, so that the research can be focused and relevant to the predetermined objectives. By making thorough observations and examining the characteristics of the population, the research can proceed with an informed approach that meets the expected objectives.

Design. In the Design stage, there are two important steps to be taken. The first step is to create a web-based learning media prototype in accordance with the operating system course syllabus. In this step, the learning content is adjusted to the material relevant to the syllabus. After the prototype is designed, the next stage focuses on the development of web-based learning media. In this stage, the operating system learning materials, from BIOS setting to the whole operating system installation process, were created using the prototype design as a reference. Through these steps, the research ensured a systematic approach and aligned with the targeted educational objectives and syllabus requirements. In this Design stage, the research instrument was also designed in the form of a questionnaire that would be used to measure the practicality of the learning media that had been developed. With this questionnaire, researchers can obtain useful information regarding the effectiveness and level of practicality of the web-based learning media that has been created.

Develop. In the Develop stage, there are several important activities to be done. First, researchers implemented the web-based mobile learning platform based on the previously designed framework. Next, we tested the web-based mobile learning media to a predetermined sample group of students. The purpose is to collect data and feedback on the practicality of the web-based mobile learning in improving students' ability to understand how to install an operating system correctly by applying the process stages that have been explained in the learning materials. This data and feedback will be used to evaluate the developed learning media and identify potential areas for improvement in the next stage. Through this Develop stage, researchers can produce a relevant and effective web-based mobile learning platform, which in turn can improve student learning outcomes in operating system courses. Thus, the Develop stage is a critical step in creating a learning solution that is useful and suits the needs of the students.

Disseminate. During the Dissemination stage, various activities were conducted to effectively share the research findings with relevant stakeholders. First, the researcher collected data through questionnaires administered to a sample group of university students. The collected data was then analyzed descriptively to gain meaningful insights. Next, the results of the analysis were interpreted and presented in a comprehensive research report. In addition, researchers prepared scientific articles for publication in reputable international journals. The primary objective of this stage is to disseminate and share the research findings with the scientific community and practitioners in the field of information technology education, particularly focusing on learning operating system installation. Through this effort, the researchers aspire to contribute to and facilitate the advancement of the information technology education study program by promoting the effective and efficient utilization of web-based mobile learning platforms.

3.2 Population and sample

The population in this study were 127 students of the information technology education study program, faculty of teacher training and education at Muara Bungo Muhammadiyah University, Indonesia, in semester 3 of the 2022–2023 academic year. This study used a simple random sampling technique where the sample used amounted to 43 students who took the operating system installation course.

3.3 Data collection instruments

The practicality instrument was used to obtain data on the level of usability of web-based mobile learning. This practicality instrument is described using Likert Scale. The practicality instrument grids for student and lecturer responses can be seen in Tables 1 and 2 [49].

Table 1. Lecturer response practicality instrument lattice

Aspect	Indicator
Learning Aspects	Clarity and suitability of learning objectives, competency maps for mobile learning materials
	Suitability and coverage of material with the learning objectives of the operating system course
	Applicability of the module as independent learning
Material Aspect	Coverage and factualization of the contents of the operating system course material
	The suitability and attractiveness of the contents of the operating system course material
Design Aspect	Readability of the text and the use of sentences used
	Ease of program operation
	Accuracy and clarity of multimedia display in supporting operating system course material
	Ease of understanding the material and motivating students

Table 2. Practicality instrument lattice of student response

Aspect	Indicator
Learning Aspects (Curriculum)	Clarity of identity and learning outcomes
	Suitability and fixity of material to be learned
	Clarity of web-based mobile learning material
Display Aspect	Attractiveness of web-based mobile learning elements
	Readability of layouts that make it easy for users to learn using web-based mobile learning
	Clarity of multimedia display supporting mobile learning material
	Attractiveness of mobile learning graphic display
Programming Aspect	Ease of program operation
	Ease of program interaction

The research aims to gather insights on the practicality of web-based mobile learning through questionnaires administered to students. These questionnaires are designed to elicit responses and opinions from students regarding the practicality of web-based mobile learning. The questionnaire comprises statements related to the practicality of web-based mobile learning, and students are provided with alternative answers. These alternatives include "strongly agree," "agree," "disagree," "strongly disagree," allowing students to indicate their level of agreement or disagreement with each statement.

The practicality of the learning module through e-learning is as follows.

a) Answer score with criteria: 5 = Very-Practical, 4 = Practical, 3 = Practical-Enough, 2 = Less-Practical, 1 = Not-Practical.
b) Determine the average score obtained by summing the values obtained from many indicators.
c) Giving practicality value with the formula:
$NA = S/M \times 100\%$
Description:
NA = Final score
S = Score obtained
SM = Maximum score
d) To determine the level of practicality of the learning module through e-learning, the criteria are shown in Table 3.

Table 3. Media practicality categories

No	Achievement Rate (%)	Category
1	85–100	Very Practical
2	75–84	Practical
3	60–74	Practical-Enough
4	55–59	Less Practical
5	0–54	Not Practical

4 RESULTS AND DISCUSSION

4.1 Design results

The next activity after analyzing the initial stage is to design and develop a web-based mobile learning prototype, which consists of: (1) Home Page; (2) Learning Content; (3) Learning Materials; (4) Learning Videos; (5) Online Chat. In more detail, the format of web-based mobile learning is explained as follows:

This page serves as the initial dashboard menu for the web-based mobile learning platform used in the operating system course. This interface is designed to provide access to the operating system course materials. The layout and design of the Main Page is made consistent, students who want to do online learning must log

in first by entering the username and password previously given by the lecturer teaching the operating system course. The visual representation of the main page interface design is presented in Figure 2.

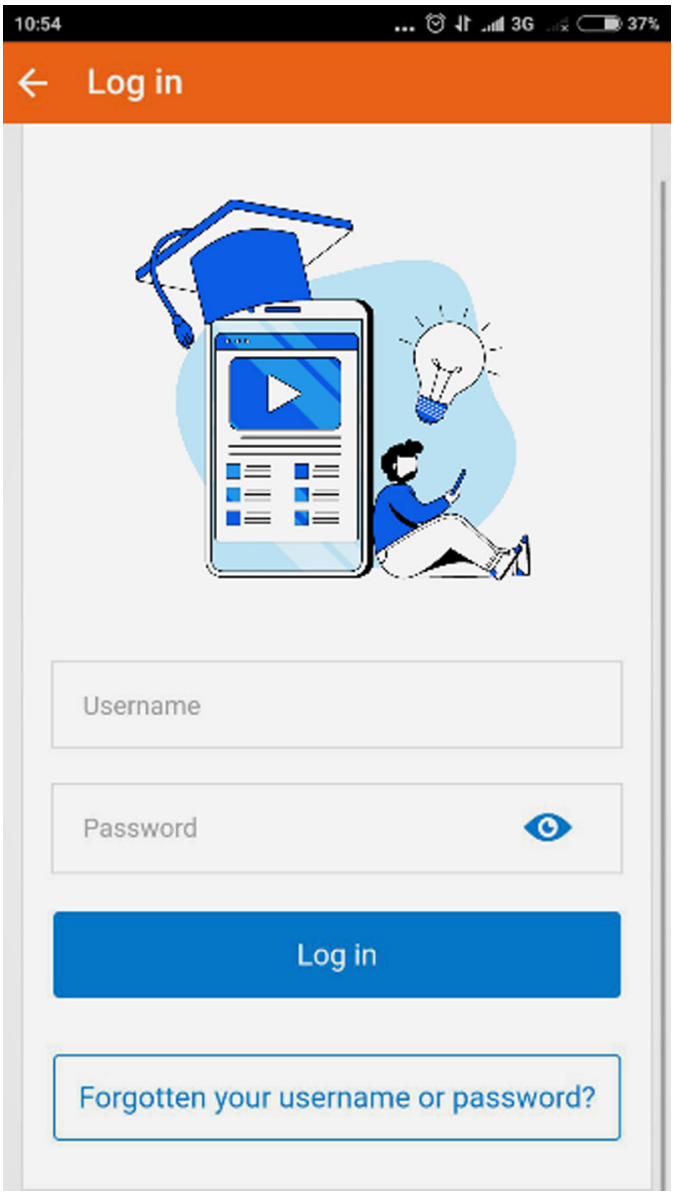

Fig. 2. Dashboard menu

The operating system installation material in the web-based mobile learning application is presented in the form of menu and icon displays, here is the mobile learning material menu: Timeline–Guidance; Main Page; Guidance Value; Notification; Personal Message; Guidance Calendar; Google Search; Guidance Card; YouTube Channel; School Information System; Developer; Settings; Log out, as shown in Figure 3.

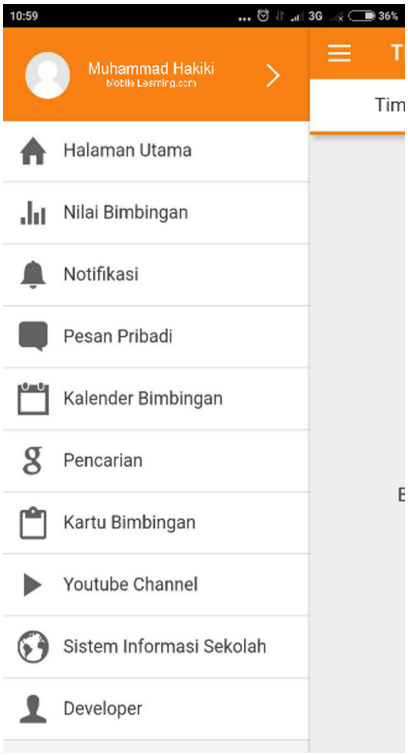

Fig. 3. Operating system installation material display

This learning material display displays operating system installation material that is adjusted to the syllabus consisting of all basic competencies in the odd semester of the 2022/2023 school year consisting of 18 meetings. This mobile learning has a download feature so that all downloaded materials can be read even though it is no longer connected to the internet network or in an offline state. The scope of the material contains all the scope of the operating system installation mathematics material, presented in the Figure 4.

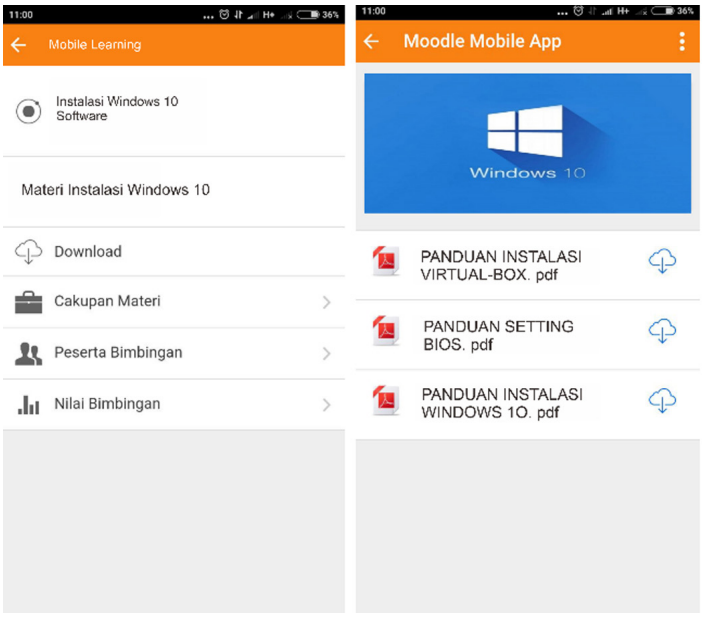

Fig. 4. Display of the contents of the operating system learning material

The online tutoring process is also supported by an online assignment collection feature. In addition to private messages, there are also communication channels such as online chat and discussion rooms for interactivity between users, as shown in Figure 5.

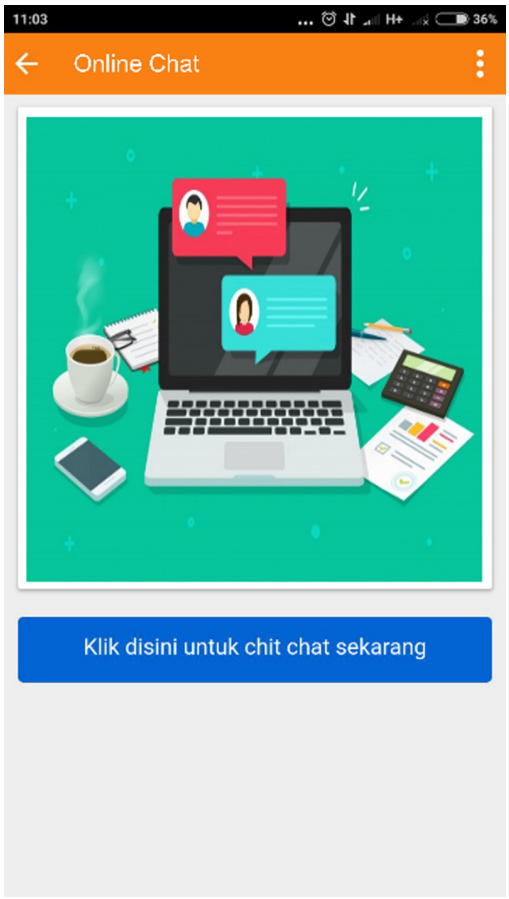

Fig. 5. Online chat

4.2 Research results

Analysis test trial data based on reliability test of practicality instrument. Based on the results of the reliability test of the practicality questionnaire, the following results were obtained.

Table 4. Recapitulation of reliability test of student practicality instruments

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.936	.945	26

The results of the reliability test analysis in Table 4 using the IBM SPSS 21 program with a Cronbach's Alpha value of 0.936 with a very high interpretation. So, it can be concluded that the practicality questionnaire is reliable to measure the practicality of the web-based mobile learning developed from the students' point of view.

Practicality test data of web-based mobile learning

Lecturer response to the practicality of web-based mobile learning in operating system courses. The practicality of web-based mobile learning is closely tied to its ease of use. To assess practicality, a questionnaire was administered to a lecturer teaching the operating system course. The summarized results of the practicality assessment through web-based mobile learning are presented in Figure 6 below.

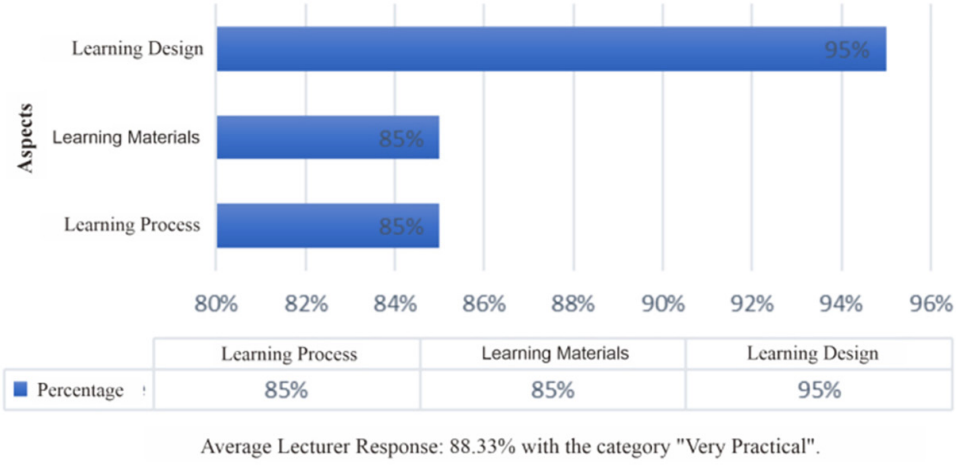

Fig. 6. Lecturers' response to the practicality of web-based mobile learning

The analysis of the data revealed an average practicality score of 88.33% based on the assessment of web-based mobile learning using a questionnaire administered to the lecturers. This high percentage indicates a highly practical interpretation of the developed media. Furthermore, the lecturer response questionnaire specifically focused on web-based mobile learning in operating system courses, resulting in highly practical outcomes.

Responses to the practicality of web-based mobile learning in operating system courses. The practicality of web-based mobile learning also relies on gathering feedback from students. This feedback is collected using web-based mobile learning in operating system courses, wherein students are asked to complete a questionnaire. The findings from the assessment of the practicality of the learning media are presented in Figure 7 below.

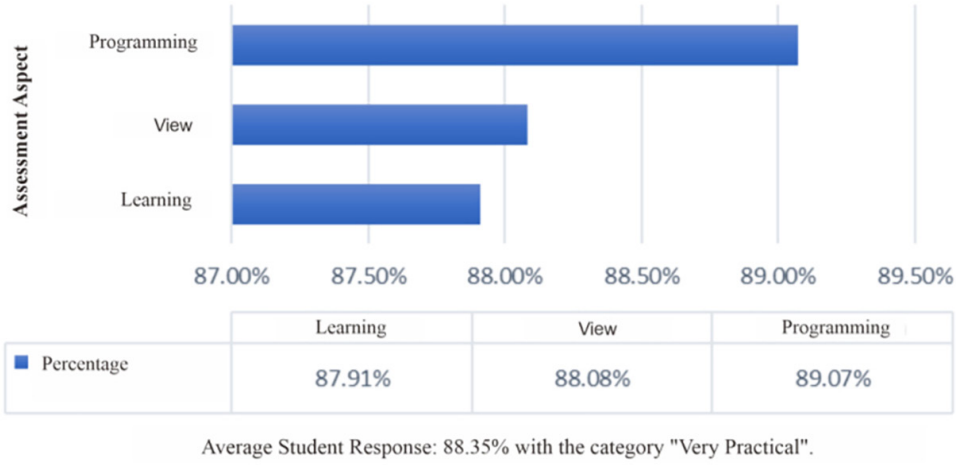

Fig. 7. Student response to the practicality of web-based mobile learning

Based on the data presented in Figures 6 and 7, the average practicality scores for web-based mobile learning, as assessed by both lecturers and students, were found to be 88.33% and 88.35%, respectively. These results indicate that web-based mobile learning in operating system courses falls within the category of "very practical."

4.3 Discussion

This research successfully identified challenges and strategies to improve the practicality of web-based learning on mobile devices, especially in learning operating system courses. Through a comprehensive development approach, we were able to address the issues of accessibility limitations, user interface, and logistical aspects to create a more practical and efficient learning experience. The advantage of this study compared to other studies lies in the high practicality score achieved for web-based mobile learning in operating system courses. Based on the data, the average value of practicality obtained from lecturers and students is 88.33% and 88.35%, respectively. This value indicates that the web-based mobile learning platform developed in this study has a high level of practicality. Compared to other similar studies [50], it was concluded that the average assessment of the practicality of Android-based Graphic Design learning media by students was 4.25 with an achievement level of 85.00 and was on good criteria (practical). This means that the practicality of Android-based Graphic Design learning media can be applied. Based on the results of research conducted on Android-based static and dynamic electricity learning media research, it states that static and dynamic electricity learning media are easy or practical to use by teachers and students.

The strength of this study lies in the high practicality score of "very practical" category with 88%, which indicates that the developed web-based mobile learning platform can overcome the challenges usually faced in operating system courses, such as limited access and user interface issues. The platform's design and implementation consider the specific needs of operating system courses, leading to a seamless and efficient learning experience. The high practicality scores also suggest that the developed web-based mobile learning platform addresses the challenges typically faced in operating system courses, such as accessibility limitations and user interface issues. This research considers the logistical aspects, affordability, and flexibility of accessing learning materials, which positively impact students' engagement and learning outcomes. By achieving a "very practical" category rating, this research distinguishes itself from other studies by providing a more robust and reliable web-based mobile learning solution for operating system courses. The platform's effectiveness in enhancing the learning experience and outcomes for students sets it apart as an exemplary approach in the field of information technology education. Overall, the high practicality scores obtained in this research highlight the superiority of the developed web-based mobile learning platform compared to other studies, making it a promising and effective solution for delivering operating system courses in diverse educational settings.

Although this study has limitations in the specific context studied, our findings make an important contribution to the development of web-based learning on mobile devices. It is hoped that the results of this study can guide educators and learning designers to create more effective and engaging learning experiences for students in the context of operating system courses. Looking ahead, future opportunities such as the integration of advanced technologies, personalized mobile learning, and increased internet access offer the potential to continue to improve the practicality

of web-based learning on mobile devices. By capitalizing on these opportunities and continuing to address emerging challenges, we can achieve web-based learning that is more adaptive, interactive, and relevant to the needs of students taking operating systems courses.

5 CONCLUSION

This research aims to develop Web-based Mobile Learning to improve learning effectiveness in operating system courses. However, when applied to operating system courses, practicality challenges may hinder the effectiveness and accessibility of learning materials for students. To overcome these challenges, this Research and Development (R&D) study adopted the systematic 4D model, focusing on the Define, Design, Develop, and Disseminate stages. Through a comprehensive approach, the research successfully identifies and explores strategies to optimize the practicality of the web-based mobile learning platform in the context of operating system courses. Data collected from both lecturers and students indicate high average practicality scores, reaching 88.33% and 88.35%, respectively. The study's findings contribute valuable insights and recommendations for enhancing the practical aspects of web-based mobile learning in operating system education. By carefully integrating practical considerations, such as user-friendly interfaces and accessibility features, the learning experiences, and outcomes for students in this context can be significantly improved. Ultimately, this research provides a stepping stone towards creating more efficient and effective web-based mobile learning environments, fostering better engagement and success for students in operating system courses. The findings also encourage educators and instructional designers to continue exploring advanced technologies and personalized learning approaches to further enhance the practicality and effectiveness of Web-based Mobile Learning in the evolving landscape of education. By continuously addressing emerging challenges, we can ensure that Web-based Mobile Learning remains a promising approach in modern educational practices.

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