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An AI-Assisted Mobile Application for Personalized Learning in Secondary Education

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***Abstract*—The development of Artificial Intelligence (AI) provides opportunities to support personalized learning, particularly at the secondary school level, where students have diverse learning needs. This study aims to develop an AI-assisted mobile application prototype to support personalized learning and assist teachers in monitoring student progress. The research adopts a Research and Development (R&D) approach, which includes stages of user needs analysis, system design, prototype development, and user evaluation. The application was developed in two versions: a student application and a teacher application, both implemented on Android devices. The student application provides features such as a learning dashboard, adaptive quizzes, learning analytics, feedback, and rule-based learning recommendations derived from student performance, while the teacher application offers class monitoring, grade input, and learning material upload functionalities. The evaluation involved 43 students and 3 teachers using usability questionnaires. Results indicate that more than 85% of students found the application easy to use and beneficial in supporting their learning, while teachers reported that the system supports monitoring and instructional activities. These findings suggest that the proposed application is feasible and well-accepted as a personalized learning support tool. However, further studies are required to evaluate its impact on learning outcomes using more rigorous experimental methods.**

***Index Terms*— Artificial Intelligence, Personalized Learning, Mobile Application, Secondary Education, Adaptive Learning**

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I. INTRODUCTION

THE rapid development of digital technology over the past two decades has brought significant changes across various sectors, including education. One of the most prominent innovations is the utilization of Artificial Intelligence (AI) to support the learning process. AI functions not only as a tool for delivering instructional content but also as an intelligent system capable of analyzing, adapting, and personalizing students' learning experiences. Through AI, learning that was previously uniform can be customized to meet individual students' needs, abilities, and learning pace [1], [2].

At the secondary education level, learning challenges are relatively complex. Students are in a phase of dynamic cognitive and emotional development. Differences in learning styles, motivation, and academic backgrounds result in highly diverse educational needs. Teachers often face difficulties in providing personalized attention to each student, particularly in large classes with a high number of learners. In this context, AI emerges as a potential solution to provide more adaptive and effective learning experiences [3], [4].

In addition, teacher readiness is a critical factor. Educators are not only required to master subject matter but also to operate and integrate AI technology into instructional methods. A lack of training and awareness regarding AI can hinder the optimal utilization of this technology [4], [5]. Without adequate teacher preparedness, the use of AI risks becoming merely a technological trend without producing significant improvements in learning quality.

Despite these challenges, the opportunities offered by AI in secondary education remain substantial. Integrating AI through mobile applications represents a strategic solution. Mobile applications are relatively easy to access, particularly among secondary school students who are generally familiar with smartphone usage. By developing AI-assisted mobile applications, learning systems can reach a broader range of students in a practical, flexible, and personalized manner. Such applications can be designed to adapt learning materials,

provide adaptive quizzes, and deliver automated feedback tailored to students' individual learning pace [1], [2].

Therefore, this study is important in developing an AI-assisted mobile application capable of personalizing learning at the secondary education level. The proposed application is expected to address the challenge of limited personalization in large classrooms while simultaneously leveraging the opportunities offered by advancements in AI technology. With AI support, the learning process in secondary education can become not only more effective but also more inclusive, adaptive, and aligned with individual students' needs [2], [3].

However, despite the growing number of AI-based learning systems, many existing studies focus primarily on either student-facing applications or algorithmic models, with limited integration between student learning features and teacher monitoring tools in a single mobile platform. In addition, several systems lack practical implementation in real classroom settings, particularly at the secondary education level.

Therefore, this study aims to fill this gap by developing an integrated mobile application that combines student learning personalization features with teacher monitoring capabilities, supported by a practical recommendation mechanism based on student performance data.

II. Literature Review

Numerous studies have demonstrated the significant potential of AI in supporting personalized learning. According to Jian [6], [7], AI can help tailor learning materials to individual students' abilities, allowing them to learn at a pace more aligned with their capacities. This finding is reinforced by the study conducted by Dumbuya [8], which revealed that AI can enhance learning effectiveness by providing more relevant and focused learning recommendations [2]. These findings indicate that AI is not merely a technical support tool, but also a strategic partner in improving educational quality [1].

Furthermore, recent international studies also support this claim. Research by [9] developed an AI-based smart tutoring system capable of adaptively adjusting learning materials to students' needs, which was shown to improve both comprehension and learning motivation [5], [9]. Similarly, [10] emphasized that AI can analyze students' learning data to provide personalized feedback, enabling secondary school students to learn according to their individual abilities [10].

The study by [11] further found that the integration of AI in secondary education can assist students who frequently struggle to understand learning materials. AI systems can offer alternative learning pathways tailored to individual learning styles, thereby narrowing academic gaps in heterogeneous classrooms [4], [11]. Thus, AI has the potential not only to enhance learning effectiveness but also to promote equity in educational access [3].

Nevertheless, the implementation of AI in education is not without challenges. One major issue is limited access to technology, particularly in secondary schools located in areas with inadequate infrastructure. Not all schools possess sufficient hardware facilities or reliable internet connectivity to support AI-based application systems. Another challenge concerns data ethics. AI operates by collecting and analyzing individual students' learning data, which poses risks related to data misuse and privacy violations if not properly managed. Research by [12] highlights that teachers' limited understanding of AI technology and ethical issues related to student data usage constitute major barriers to the implementation of AI systems in secondary schools [4], [5], [12].

Table 1. Comparison of Existing AI-Supported Educational Systems

Study	Platform	AI Personalization	Teacher Support	Limitation
[2]	Web / General	Content recommendations & learning paths	Data visualization & analytics	Lacks a dedicated mobile app ecosystem for secondary education.
[4]	Web (ChatGPT)	Content tailoring	Curriculum adaptation	Relies on external AI tools; lacks an integrated student tracking system.
[9]	Intelligent Tutoring Systems	Adaptive learning	Automated grading & analytics	Broad focus; no specific dual-user (student-teacher) mobile application.
[11]	Web / Mobile	Virtual assistance chatbot	Admin support	Focused on higher education administration, not K-12 academic learning.
Proposed Study	Mobile (Android)	Adaptive Quizzes & Priority-Based Recommendations	Integrated Dashboard & Real-Time Grading	None / Not applicable

While recent literature extensively documents the benefits of AI in education, a noticeable gap remains in the practical integration of these technologies into a unified, accessible ecosystem. As illustrated in Table 1, existing research frequently isolates specific functionalities, such as general adaptive learning systems [2], the use of external generative AI for curriculum adaptation [4], or chatbots for higher education administration [11]. Furthermore, studies highlighting AI as a co-teacher [9] often focus on theoretical frameworks or web-based tutoring systems lacking mobile accessibility. Consequently, there is a

distinct need for a holistic mobile application tailored for secondary education. This study bridges this gap by proposing an integrated Android-based platform that concurrently delivers AI-assisted personalized learning for students and real-time academic monitoring for teachers.

III. Research Methodology

This study aims to develop an Artificial Intelligence (AI)–assisted application for personalized learning at the secondary school level. The research methodology consists of several stages, including user needs exploration, AI algorithm design, prototype development, testing and evaluation, and system refinement. Each stage produces specific outputs aligned with the targeted performance indicators and involves designated research team members and partners responsible for each phase of the study.

A. User Needs Exploration Stage

This stage aims to understand the needs of both students and teachers in a personalized learning system. The methods employed include a literature review of previous studies, as well as interviews and focus group discussions with secondary school teachers and students to identify challenges in conventional learning practices. The activities conducted involve reviewing literature on AI-based personalized learning, conducting interviews to explore difficulties in adapting learning materials, and analyzing system requirements based on the collected data. The outputs of this stage include a user needs exploration report and a system requirements specification document. The achievement indicators consist of the identification of key features required in the application and a mapping of learning challenges at the secondary school level that can be addressed through AI. At this stage, the principal investigator is responsible for coordinating the needs exploration process, while research team members analyze relevant literature on AI technologies in education.

B. AI Algorithm Design Stage

This stage is conducted based on the results of the user needs exploration, with the objective of designing algorithms capable of analyzing students' learning patterns and adapting learning materials in real time. The activities include developing adaptive AI models to analyze student interactions within the application, designing a competency-based learning framework that enables AI to personalize learning pathways for each student, and conducting preliminary testing of the algorithms in a simulated environment to ensure accuracy in adapting learning materials. The outputs of this stage include an adaptive AI model for personalized learning and an application system architecture document. At this stage, education experts are responsible for designing a competency-based curriculum aligned with the AI algorithms, while programmer team members develop machine learning–based learning algorithms and the system backend to support AI functionality.

Adaptive Recommendation Mechanism

The personalization mechanism in this study is implemented using a rule-based approach rather than a complex machine learning model. The system analyzes student performance based on quiz scores and categorizes them into different levels.

Students with scores below 75 are recommended reinforcement materials, while students with scores above 85 are given advanced learning materials. The recommendation priority is determined based on score ranges, where lower scores correspond to higher priority levels.

This approach allows the system to provide adaptive learning suggestions in a simple yet interpretable manner, suitable for early-stage prototype development.

C. Prototype Development Stage

The objective of this stage is to build an initial version of the application, in which the previously designed AI algorithms are implemented in the form of an interactive prototype. The activities include developing a user interface (UI/UX) for the AI-assisted mobile application, integrating the AI algorithms with the competency-based learning system, and conducting internal testing to ensure application stability prior to deployment in schools. The output of this stage is an initial application prototype, with the achievement indicator being the availability of AI-assisted personalized content features that can be interactively used by students. During this stage, programmer team members are responsible for application development, while research team members support the integration of learning algorithms into the system.

D. Testing and Evaluation Stage

This stage involves 43 secondary school students and 3 teachers from SMK Buddhi as test subjects to measure the effectiveness of the application in improving learning comprehension and engagement. During the evaluation, students used the application prototype in a trial session and subsequently completed a usability questionnaire, while teachers interacted with the system and provided feedback based on their experience. The activities include testing the application with groups of students possessing different levels of learning ability, analyzing student engagement and improvements in comprehension after using the application, and collecting feedback from both teachers and students regarding the strengths and limitations of the application. The outputs of this stage include a report on the application's effectiveness testing, as well as recommendations for system improvements. At this stage, educational evaluation experts design the methods for assessing learning effectiveness, while partner schools provide access for conducting classroom-based testing.

E. System Refinement Stage

This stage is conducted following the testing process,

during which the system is improved based on user feedback and the results of the effectiveness evaluation. The activities include analyzing testing data to identify deficiencies in the AI algorithms and application features, optimizing the system based on evaluation results and user input, and preparing the research findings for publication in scientific journals. The outputs of this stage include a finalized and optimized version of the application and the publication of research findings in nationally accredited journals. The achievement indicators include an application that is ready for broader-scale implementation and scientific publications that demonstrate the research contribution. At this stage, programmer team members are responsible for optimizing application features based on testing results, while education experts ensure the alignment of the improved system with appropriate learning models.

IV. Result and Discussion

The developed application prototype was installed on Android-based smartphones. Two applications were developed, namely a student application and a teacher application.

A. Student Application

The student application begins with a login page, as shown in Fig. 1, where students are required to enter their student ID and the password that has been provided to them.

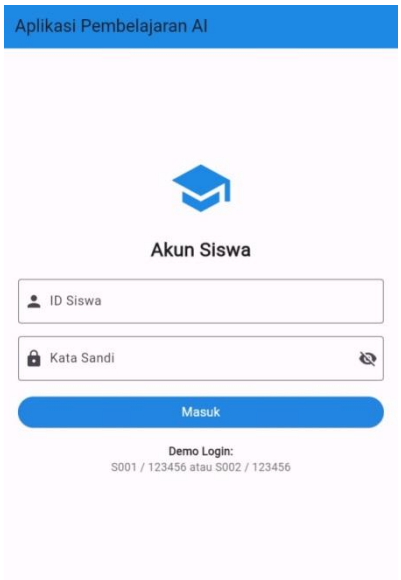

Fig. 1. Student application login page

After logging in, users are redirected to the dashboard which is divided into four sections, as shown in Fig. 2. The first section displays a welcome message along with the student's name and class. The second section is the dashboard summary, which includes scores, activities, and recommendations. The score represents the total points obtained by the student. Activities refer to the number of learning activities completed by the student, such as completing adaptive quizzes and studying materials provided by the teacher. Recommendations indicate the number of AI-generated recommendations available to the student.

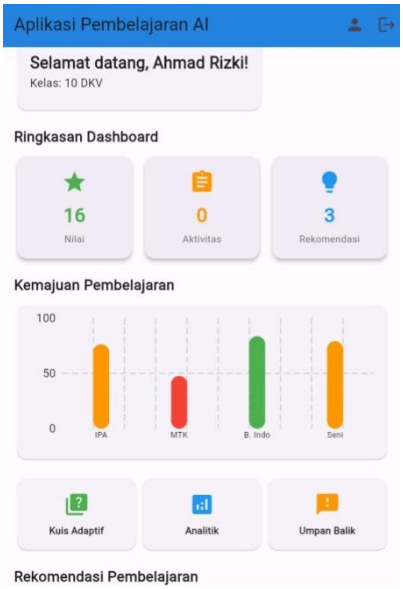

Fig. 2. Student application dashboard page

The third section presents learning progress displayed in the form of charts or graphs showing the average scores for each subject currently taken by the student. The charts provide interactive visualizations that display subject-specific scores. The average scores are derived from the grades entered by teachers. Differences in color for each subject indicate different performance levels: green represents scores in the range of 80–100, orange represents scores in the range of 60–79, and red represents scores in the range of 0–59. The score data are updated in real time, meaning that the information is automatically refreshed whenever teachers enter new grades.

Below this section, as shown in Fig. 3, adaptive quizzes are provided, consisting of five questions for each subject. To answer the questions, students select a subject and are then redirected to the question page, where a 10-minute timer is initiated. The quiz questions are presented in two formats: multiple-choice, as shown in Fig. 4, and open-ended (essay) questions, as shown in Fig. 5. For multiple-choice questions, as shown in Fig. 6, when a student selects the correct answer, the score increases and the correct answer is highlighted in green. If an incorrect answer is selected, as shown in Fig. 7, the score does not increase, and the correct answer is immediately displayed in green, while the incorrect answer is highlighted in red. For open-ended questions, students provide their answers in text form. If the answer is correct, the score increases; if the answer is incorrect, the score does not increase, and the correct textual answer is provided.

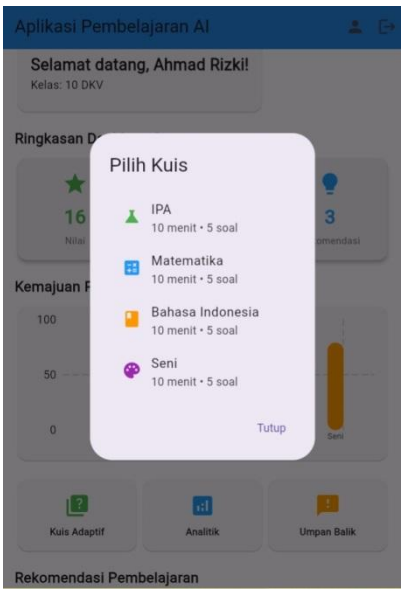

Fig. 3. Adaptive quizzes for various subjects

Fig. 4. Adaptive quiz multiple choice questions

Fig. 5. Adaptive quiz open-ended (essay) questions

Fig. 6. Correct answers to multiple choice questions

Fig. 7. Wrong answer to multiple choice question

The next feature is the analytics section, which presents learning time, average scores, and graphical representations of students' learning progress for each subject, as shown in Fig. 8. Learning time increases whenever students engage in activities such as studying learning materials, watching instructional videos, or completing adaptive quizzes. Feedback is provided in the form of informational messages, including learning suggestions, special attention alerts, achievements, and AI-generated learning recommendations for students based on each subject, as shown in Fig. 9. Different colors are used to indicate feedback categories: green represents success, orange indicates suggestions, and red signifies special attention that needs to be addressed.

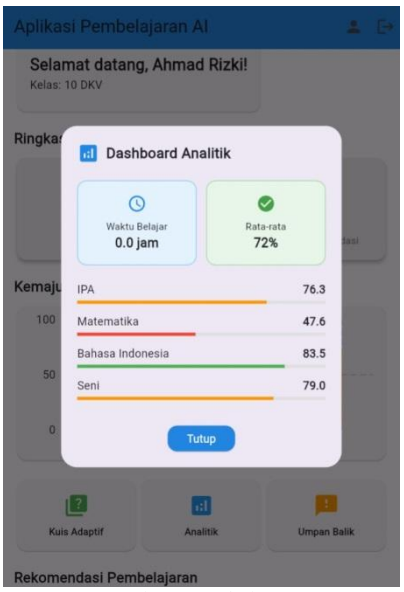

Fig. 8. Analytics

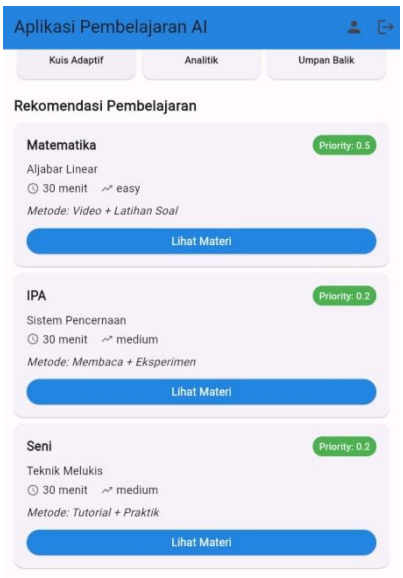

Fig. 10. Learning recommendations

Fig. 9. Feedback

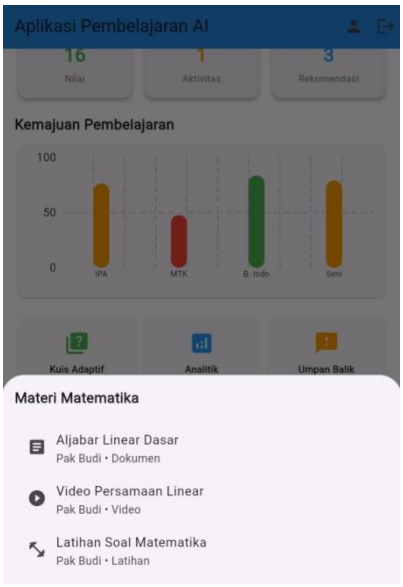

Fig. 11. Learning materials

Learning recommendations are generated based on AI analysis, as shown in Fig. 10. The AI analyzes student performance for each subject. Scores below 75 receive recommendations for reinforcement of learning materials, while scores equal to or greater than 85 are assigned advanced learning challenges. Recommendation priorities are displayed based on the lowest scores, with high priority ranging from 0.8 to 1.0, medium priority from 0.3 to 0.7, and low priority from 0.1 to 0.2. The estimated time indicates the recommended study duration, ranging from 30 to 60 minutes. When a recommendation is selected, access to subject-specific learning content is provided, as shown in Fig. 11. The types of materials available include documents, videos, and practice exercises. Documents are provided in PDF format containing reading materials and conceptual explanations. Interactive instructional videos are delivered via links provided by the teacher. Practice exercises and problem-solving activities are offered to help students better understand the learning materials.

In the header, a student profile icon is available and can be accessed, as shown in Fig. 12. On the student profile page, the upper section displays personal information, including the student's name, ID, and class. This is followed by learning statistics, which include total scores, the number of completed activities, and the number of AI-generated recommendations. Additionally, a summary of scores for each subject is displayed. Different colors indicate whether the scores have reached the passing threshold: green represents excellent performance for scores equal to or greater than 80, orange indicates good performance for scores in the range of 70–79, and red signifies the need for improvement for scores below 70.

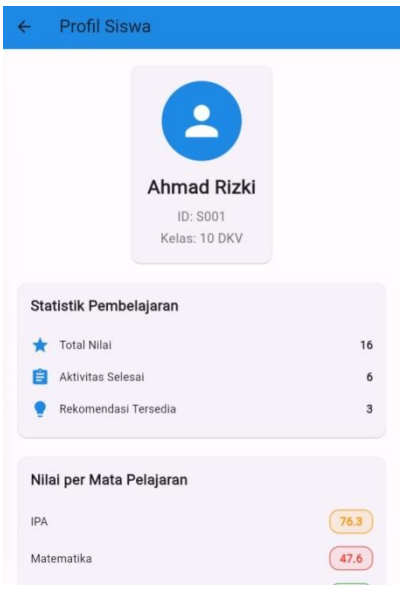

Fig. 12. Student profile

The personalization aspect of the application is reflected in how the system adapts learning recommendations based on individual student performance. Unlike static learning systems, this application continuously updates recommendations based on quiz results and activity data, allowing students to receive learning materials that match their current level of understanding.

B. Teacher Application

The teacher application begins with a login page where teachers enter their teacher ID and password, as shown in Fig. 13.

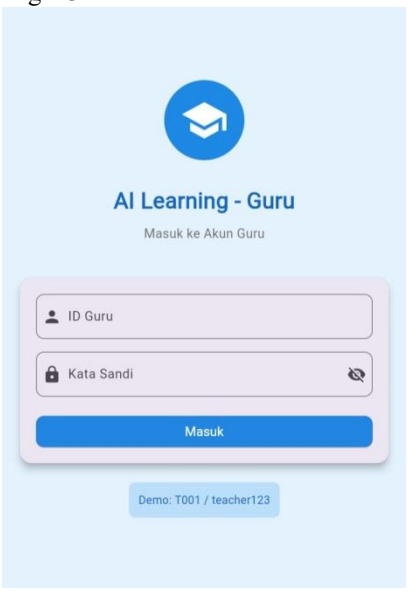

Fig. 13. Teacher application login page

After logging in, teachers are directed to the main page, which serves as the dashboard and displays a welcome message along with the teacher's name and the subject(s) taught, as shown in Fig. 14. The dashboard also presents class statistics, including the number of students in the class, the grades that have been entered, and the class average score. In addition, a "recent students" section provides real-time student data, including student names, class information, total scores, and average scores.

Fig. 14. Teacher application dashboard page

The student menu contains more detailed student data, including the student's full name, class, total entered scores, and average score, as shown in Fig. 15. In the grade input menu, teachers can enter student grades by selecting the student's name and the subject, and then inputting the score. After saving the data, a notification is displayed to indicate that the grade has been successfully saved, as shown in Fig. 16.

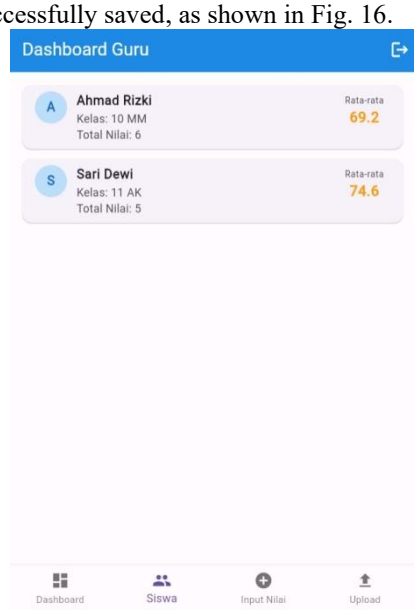

Fig. 15. Student menu page

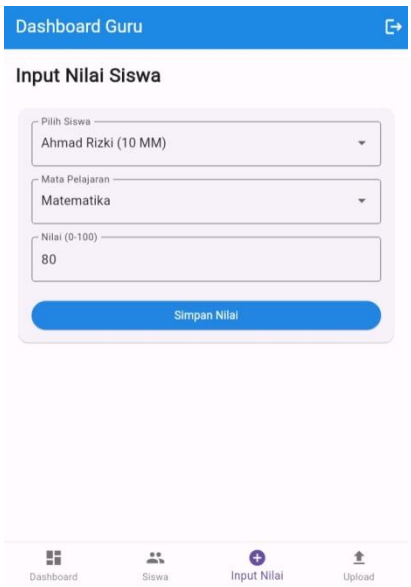

Fig. 16. Student grade input page

In the upload menu, teachers can upload learning materials in PDF format. Teachers are required to complete the material title, description, and related subject, along with uploading the PDF file. Once the data are saved, a notification appears to confirm that the learning material has been successfully uploaded, as shown in Fig. 17.

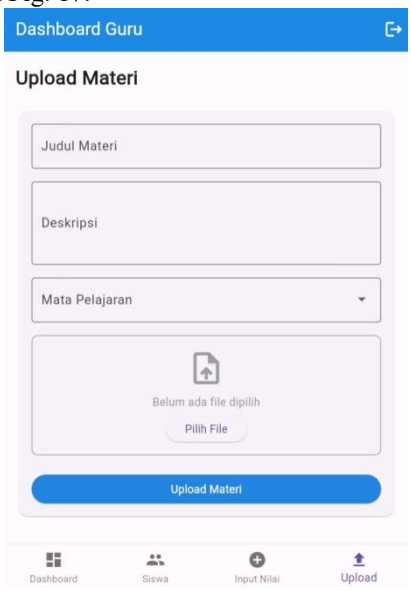

Fig. 17. Teacher material upload page

From a pedagogical perspective, the teacher application supports data-driven instruction. Teachers can monitor student performance, identify students who require additional support, and provide targeted learning materials. This enables more efficient intervention compared to traditional classroom settings.

C. *Results and Discussion*

Approximately 43 students who had tried the application prototype also completed a questionnaire containing several key questions related to this study. The questionnaire used in this study was designed based on basic usability indicators, including ease of use, interface clarity, visual appeal, and perceived usefulness. The responses were analyzed descriptively using percentage distributions to provide an initial understanding of user acceptance. The first question addressed the level of difficulty they experienced when using the prototype. The results showed that approximately 90.7% of the respondents did not experience any difficulty in using the application, as shown in Fig. 18.

Fig. 18. Results of the first questionnaire

The second question examined whether the interface of the application prototype was easy to understand. The results indicated that 90.7% of the respondents found the prototype interface easy to understand, as shown in Fig. 19.

Fig. 19. Results of the second questionnaire

The third question examined whether the interface of the application prototype was visually appealing. The results showed that 86% of the respondents perceived the prototype interface as attractive, as shown in Fig. 20.

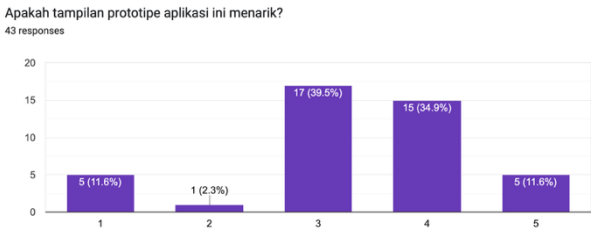

Fig. 20. Results of the third questionnaire

The fourth question examined whether the application prototype would be beneficial for students' daily learning activities. The results indicated that approximately 93.1% of the respondents considered the prototype application to be beneficial for their learning activities, particularly in helping them catch up on learning gaps, as shown in Fig. 21.

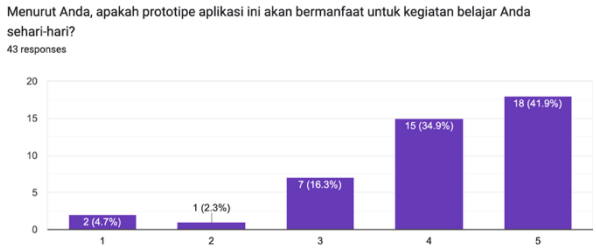

Fig. 21. Results of the fourth questionnaire

Next, a total of three teachers participated in using the learning application prototype for teachers. They also responded to several questions related to the prototype. The first question addressed the level of difficulty in using the application prototype, and the results showed that approximately 67% of the teachers found the prototype easy to use, as shown in Fig. 22.

Fig. 22. Results of the fifth questionnaire

The second question examined the ease of understanding when using the application prototype. The results indicated that 100% of the teachers considered the overall interface easy to understand within a short period of time, as shown in Fig. 23.

Fig. 23. Results of the sixth questionnaire

The third question examined whether the prototype design was visually appealing. The results showed that 100% of the teachers agreed that the application prototype design was attractive in terms of color usage, was not monotonous, and featured a modern interface, as shown in Fig. 24.

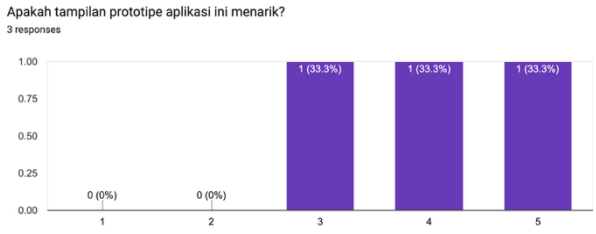

Fig. 24. Results of the seventh questionnaire

The fourth question examined whether the application prototype provided benefits for daily teaching activities. The results indicated that 100% of the teachers believed that the prototype offered substantial benefits in helping to improve students' motivation and academic performance, as shown in Fig. 25.

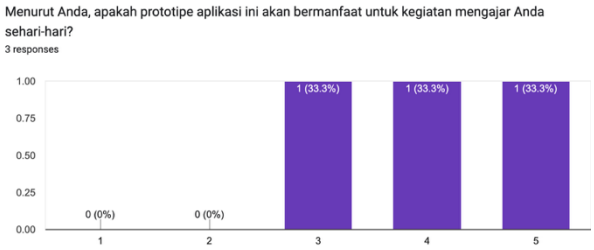

Fig. 25. Results of the eighth questionnaire

It should be noted that the evaluation in this study focuses on user perception and usability rather than direct measurement of learning outcomes. Therefore, the results should be interpreted as preliminary findings indicating system acceptance rather than proven effectiveness.

V. Conclusion

This study successfully developed an Artificial Intelligence (AI)–assisted mobile application prototype to support personalized learning at the secondary school level. The developed application consists of two versions, namely a student application and a teacher application, which are designed to be fully integrated in supporting an adaptive learning process. The system integrates student learning features and teacher monitoring tools within a single platform. Through the use of AI algorithms, the system is able to analyze students' learning performance and provide personalized material recommendations, adaptive quizzes, and feedback tailored to each student's abilities and learning pace.

The testing results indicate that the application prototype functions well on Android devices and demonstrates a high level of user acceptance. The majority of students reported that the application is easy to use, easy to understand, visually appealing, and provides tangible benefits in improving comprehension and helping them catch up on learning gaps. In addition, teachers perceived the application as effective in supporting the monitoring of students' learning progress, grade management, and the delivery of learning materials in a more structured and efficient manner. The evaluation results indicate that the application is well accepted by both students and teachers in terms of usability and perceived usefulness. However, the current study is limited to prototype testing and user perception analysis.

Overall, this study demonstrates that the integration of AI in the form of a mobile application has strong potential as an effective solution to address the limitations of personalized learning in heterogeneous

classrooms. AI-assisted learning applications not only enhance student engagement and learning motivation but also support teachers in making more informed, data-driven instructional decisions. With further development and refinement, this system has the potential to be implemented more broadly as part of the digital transformation of secondary education. Future work should include larger-scale implementation and more rigorous experimental evaluation, such as pretest-posttest analysis, to measure the actual impact on learning outcomes.

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