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Smart teacher application for supporting sustainable development in teaching and differentiated learning

Safriana ✉
Universitas Malikussaleh, Indonesia (safriana@unimal.ac.id)
Irfan, Ade
Universitas Abulyatama, Indonesia (adeirfan_matematika@abulyatama.ac.id)
Iramadhani, Dwi
Universitas Malikussaleh, Indonesia (dwi.iramadhani@unimal.ac.id)
Ula, Mutammimul
Universitas Malikussaleh, Indonesia (mutammimul@unimal.ac.id)

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Abstract

There are still difficulties for teachers in designing learning that suits the needs of students. Designing learning according to student needs takes a long time for teachers, so technology is needed that can help teachers create learning by detecting student needs in the classroom. This research aims to develop an innovative SMART Teacher application to support the achievement of the Sustainable Development Goals (SDGs) in education. This application is designed to facilitate differentiated learning so that it can meet the diverse learning needs of each student. The features are designed to be integrated, including learning materials relevant to the SDGs, adaptive assessment tools, and collaboration features to improve interaction between teachers and students. Based on the results of a study on 160 junior high school students and teachers in urban areas, it was found that the SMART Teacher application is proven to improve the quality of learning, encourage active student participation, and contribute to the achievement of SDGs.

Keywords: sustainable development goals, differentiated learning, teaching

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1. Introduction

Quality education is the foundation for achieving sustainable development goals (Ariyani & Nugraheni, 2024). In other words, quality education will easily accomplish other sustainable development goals. However, realizing quality education is not an easy task, so various supporting factors are needed in the effort to achieve it. Each country undertakes efforts to improve the quality of education in different ways. In Indonesia, efforts to achieve quality education are carried out through curriculum improvements. The government developed the Kurikulum 2013 into the Kurikulum Merdeka to adapt to global developments (Gifari & Arifin, 2024). Kurikulum Merdeka is a new curriculum in Indonesia that aims to give more flexibility and autonomy to schools and teachers (Purwati & Sukirman, 2024). Gifari et, al also clearly explain that Kurikulum Merdeka is expected to develop students' potential and abilities through critical, quality, expressive, applicative, varied, and progressive learning (Gifari & Arifin, 2024). Meanwhile Endang et, al defined Kurikulum Merdeka is an innovation in the world of education that requires teachers to play an active role in developing their competencies (Purwati & Sukirman, 2024).

The implementation of the Kurikulum Merdeka is expected to allow students to develop according to their potential and abilities so that the implementation of the Kurikulum Merdeka gets critical, quality, expressive, applicative, variation, and progressive learning (Gifari & Arifin, 2024). The Kurikulum Merdeka aims to optimize the spread of education in Indonesia with diverse intracurricular learning (Inayati, 2022) Through the Kurikulum Merdeka, the government initiated the independent learning program (Arung et al., 2023; Gifari & Arifin, 2024). However, the succes of the students in the classroom learning process can not be separated from the role and competency of teacher (Hakim, 2015). Therefore, teacher must able to know their background students as well such as learning readiness, learning style, and students' learning profile before they teach them. But, learners differ in their prior educational experiences, knowledge, interests, learning styles, personal experiences, readiness levels, motivation levels, and in their aptitudes (Desinguraj & Gnanam, 2021). Students also come from differing cultures and have different learning styles, differing levels of emotional and social maturity, even their interests differ greatly, both in topic and intensity (Tomlinson, 2001). Tomlinson reveal student's differences become important elements in teaching and learning as well (Tomlinson, 2001). That is why teacher needs teaching based on differ students profile what we know then as differentiated instruction (Tomlinson, 2001).

Safriana et, al stated teacher face several common obstacles when implementing different learning strategies (Safriana et al., 2024). One significant challenge is time constraints, as many teachers find it difficult to allocate enough time to plan and execute different lessons effectively (Napitupulu et al., 2023). Safriana noted the main obstacles faced by junior high school teachers in implementing different learning, from various studies such as (1) Conceptual and technical understanding, (2) Time and resource constrains, (3) Classroom management and student engagement, and (4) Professional development and support. In other hand, if teacher want their students to excel, they must use the above ICT tools for teaching and learning (Siddiqui, 2024). That is because technology in the classroom allows teachers to experiment more (Siddiqui, 2024). Siddiqui et, al also reveal that teaching methods and frequent feedback of student which makes education more interesting and more effective (Siddiqui, 2024). But,

To deal with that situation, we created Smart Teacher Application. Smart teacher application is a digital innovation platform in education aims to overcome teacher problems in design differentiated instruction. Smart teacher was equipped with various tools giving teacher many choice learning design based on their students' profile. Initially, this application design based on artificial intelligence, but that process still on going. However,

the integration of digital technologies has become a common practice in education by covid 19 pandemic and technology allows teachers to experiment more as well as empowers teacher and student (Siddiqui, 2024). The findings from this will help teacher in design instruction based on student's characteristic, learning style and their profile. Therefore, this study helps teachers giving alternatif of effective differentiated instruction design. To achieve this goal, this study aspires to answer questions (1) How effective smart teacher application helps teacher in designing differentiated instruction, (2) How teachers' perception after using Smart Teacher application?

2. Method

2.1 Research Design

This study is qualitative research with a type of case study. The cases studied are the challenges faced by teacher in implementing Smart Teacher Application in designing differentiated instruction. According Cresswel (Creswell et al., 2007), case study research studies an issue explored through one or more cases within a bounded system (i.e., a setting or a context). This research can help in making a decision or coming conclusion about differentiated instruction design. However, this research can help teacher not only know how Smart Teacher Application is effective in designing differentiated learning but also how this application working in giving solution for teacher in any background profile student.

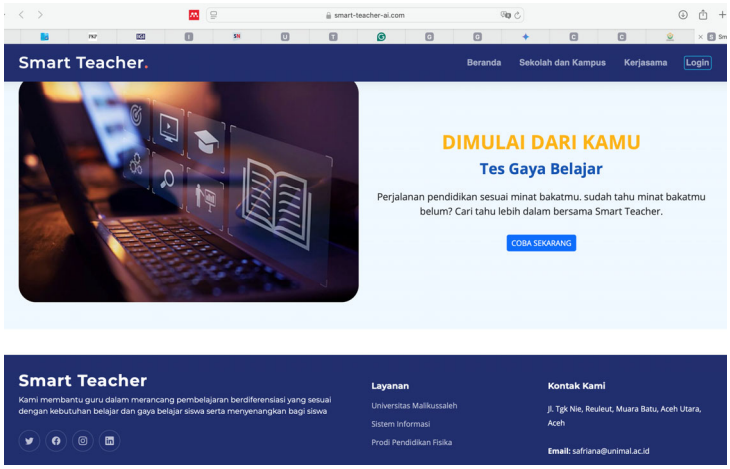

Figure 1. Smart Teacher Application (https://smart-teacher-ai.com)

2.2 Participant

Purposive sampling was used in this study. Purposive sampling procedures are used in most research papers because they are found in any research paradigm and help in ensuring that quality sample is located without biases so as to increase the reliability and trustworthiness of the findings (Friday & Leah, 2024). The sample was purposively selected from users of Smart Teacher application at one of the junior high schools in Lhokseumawe. This school was chosen as the object of research because it has been an active user of the application and one of the favourite schools in the city of Lhokseumawe. The sample of this study amounted to 160 respondents consisting of 120 junior high school third grade students and 40 teachers.

2.3 Research Instrument

The instrument of this study was made by researchers and was discussed among researchers. For this reason, researchers collected data through an online survey consisting of 21 questions among them are 11 questions for student and others for teacher.

The survey instruments used include questionnaires that measure the perception of teachers and students towards the experience of using the application, the relevance of the features, and their impact on the learning process and student motivation. The quantitative data obtained were then statistically analyzed to identify the relationship between the use of the application and the achievement of learning objectives and relevant SDGs indicators, such as education equity and education quality.

2.4 Data Collection and Analysis

Data was collected using an online survey. Online surveys are used for reason of the flexibility of compatibility of teachers and students. Fraenkel stated online surveys are easily managed and accessed using various devices (Irfan et al., 2020). The survey was open for a week. The effectiveness of the Smart Teacher application developed is measured after the application of the application in classroom learning. Data on the effectiveness of the developed application were obtained from observations, student response questionnaires, and teacher response questionnaires assessed through a four-point Likert scale (1 = strongly disagree to 4 = strongly agree), where lower scores indicate negative perceptions about the application and higher scores indicate positive perceptions. The data obtained was then analyzed to see the efficiency of the developed application. The average score for each questionnaire is determined by summing the scores for each item on the questionnaire sheet for application in learning and then determining the average. then the average score obtained is converted based on the criteria as in Table 1.

Table 1
Practicality Criteria for Smart Teacher

Score	Interpretation
$3.5 \leq Sr < 4.0$	Very Efective
$2.5 \leq Sr < 3.5$	Efective
$1.5 \leq Sr < 2.5$	Not Efective
$1.0 \leq Sr < 1.5$	Very Ineffective

In this study, the application developed has an effective value if the minimum average score reaches the effective category or the minimum average score falls into the interval of $2.5 \leq Sr < 3.5$.

3. Result and Discussion

Based on the study's results, the number of students in school who use application Smart Teacher is 120, with the distribution of data on gender in Table 2.

Table 2
Data on the distribution of students using the Application Smart Teacher

Classs	Gender		Number of Students
	Female	Male	
Grade 1st	30	10	40
Grade 2nd	35	5	40
Grade 3rd	29	11	40
Sum	94	26	120

Table 2 shows the distribution of students by gender across three grades (1st, 2nd, and 3rd). In total, there are 120 students, with a significant gender imbalance. Female students outnumber male students in all grades. Grade 1st has 30 women and 10 men, Grade 2nd has 35 women and 5 men, and Grade 3rd has 29 women and 11 men. This consistent pattern of a higher proportion of female students across all grades suggests a potential area for further investigation and consideration.

Based on the graph, it can be seen that students in grades 1, 2, and 3 generally feel more motivated to learn when teachers use differentiated learning approaches. Grade 1 students showed the highest scores regarding happiness and active participation when this approach was applied. The learning materials presented through the smart teacher application also received good assessments in all three classes, with slightly higher scores in grade

2. The app is considered to help students find out their ability level and learn according to their respective learning styles, with grade 1 feeling most helped in this aspect. All classes agreed that the features in the app are easy to understand, and that the app effectively provides information about their learning style. Overall, this application is considered a useful tool in supporting learning that suits individual needs and helps increase student motivation and participation through learning plans that are recommended by Smart Teacher and implemented by teachers in the classroom. Implementing different strategies based on learning styles, such as kinesthetic, auditory, and visual, has increased student motivation and engagement in subjects such as art (Oktiara et al., 2024). The approach encourages active participation, as students are more likely to engage with material that resonates with their individual learning preferences (Rizki & Ningsih, 2024).

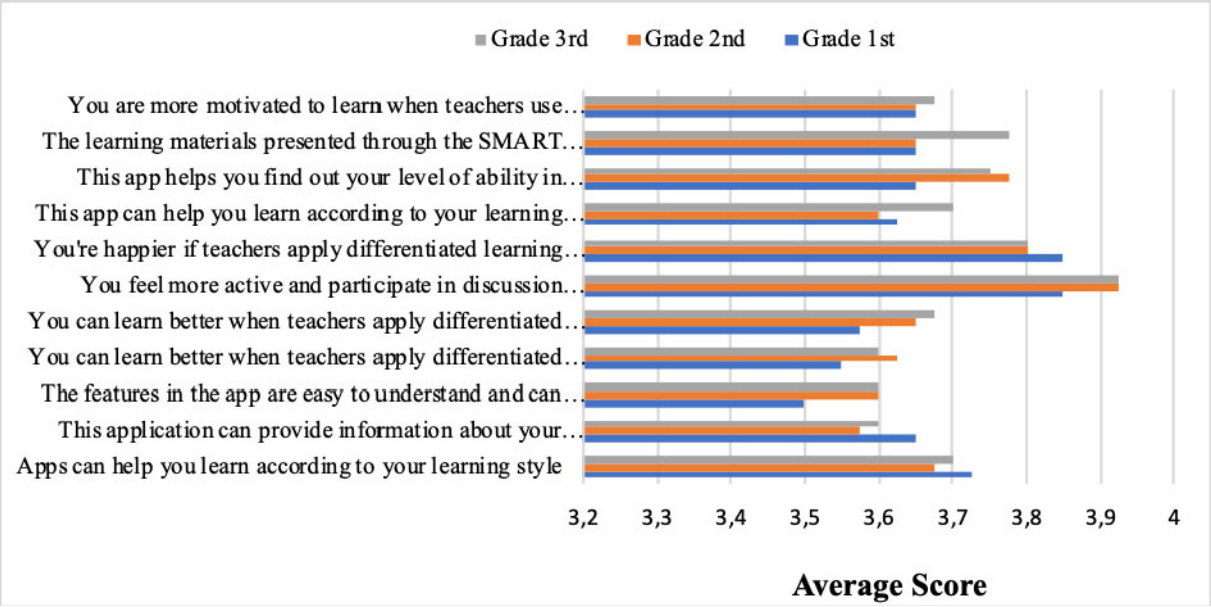

Figure 2. Student's perceptions of using Smart Teacher in supporting Differentiated learning. Number of participants grade 1st (n=40), grade 2nd (n=40), grade 3rd (n=40)

In addition, according to students' perceptions, Smart Teachers app can help them find out their learning style and the most effective way of learning for them, as well as measure the extent of their ability to understand the material being taught. This is reinforced by the results of interviews and observations on students who use the Smart Teachers AI app. They stated that the learning style test results generated by the app were very much in line with them. During this time, students realize that how they learn, whether through visual, kinesthetic, or audio, affects their ability to understand the subject matter.

To achieve optimal student learning outcomes, it is very important for teachers to adjust their teaching methods to meet the individual needs of each student. Teachers can design effective and relevant learning by understanding students' initial abilities and learning styles. The use of the smart teacher application allows teachers to continuously monitor student progress, enabling timely adjustments to the learning process.

Table 3
Data on the distribution of teachers using the Application Smart Teacher

Gender		Number of Teachers
Female	Male	
30	10	40

Table 3 shows the distribution of teachers using the Smart Teacher application by gender. Out of the 40 teachers using the application, 30 are women and 10 are men. This indicates a significant disparity in the usage of the Smart Teacher application between female and male teachers, with women constituting a larger proportion of the user base.

Table 4
Teacher Perceptions after Using the Smart Teacher Application

Statement	Average Score	Percentage
The app helps you in identifying the different learning needs of students	3,83	90%
The app helps you in creating learning materials that are tailored to the student's ability level	3,75	85%
The app is very effective in helping you provide feedback that suits the individual needs of students	3,73	82,5%
The app helps you in creating a more inclusive learning environment for all students	3,78	85%
This application can help you in implementing differentiated learning	3,65	77,5%
This application is quite complete and supports differentiated learning	3,78	80%
This application is quite complete and supports differentiated learning	3,75	82,5%
Recommended learning tools according to student needs	3,88	92,5%
This app supports continuous and inclusive Education	3,75	80%
I felt Comfortable using this app	3,78	82,5%
It is an effective app for design learning SDGs	3,43	80%

Based on the research results shown in the table, this application is considered very effective in supporting differentiated learning processes. Most respondents (90%) stated that this application is very helpful in identifying the different learning needs of each student. Additionally, 85% of respondents also believe this application helps create learning materials tailored to each student's abilities. The feature of providing feedback tailored to individual student needs also received high appreciation, with 82.5% of respondents stating that this feature is very effective. This shows that this application not only helps teachers deliver material but also provides individual support to each student. This approach can also improve teachers' ability to implement learning tailored to student needs (Inthanon & Wised, 2024; Tenenbaum & Ruck, 2007). In the end, this application is able to foster a more responsive educational environment that is in harmony with the needs of teachers and students.

This application is also highly rated for creating an inclusive learning environment. As many as 85% of respondents stated that this application helps create a more inclusive learning environment for all students. Regarding the implementation of differentiated learning, most respondents (77.5% to 82.5%) stated that this application is quite comprehensive and supports the implementation of differentiated learning. This shows that this application has met most of the teachers' needs in implementing learning tailored to the student's needs. these strategies highlight the potential for supporting SDGs in learning, but challenges remain, particularly in ensuring equitable access to technology and resources. Differentiated teaching and learning methods that suit the needs of students can be one of the strategies to include the Sustainable Development Goals (SDGs) in education (Blanco et al., 2024). Addressing these challenges requires sustained investment and policy support to fully realize the potential of education in achieving SDGs. The feature for recommending learning tools tailored to students' needs also received a very good score (92.5%). This shows that the app is able to leverage real-time data to effectively identify and meet the individual needs of students (Farr & Murray, 2016; Vázquez-Verdera et al., 2021). This data-driven approach has proven to be very helpful in designing instructional strategies that improve student understanding and retention (Intaratat et al., 2024; Yadav & Sheoran, 2024). This application demonstrates its ability to assist teachers in selecting the most suitable learning tools for each student.

Most respondents expressed comfort in using the application (82.5%) and recognized its effectiveness in supporting design learning (80%). However, it's important to acknowledge that the score for the SDG indicators, while relatively high at 3.43, still presents opportunities for further enhancement. Technologies, particularly artificial intelligence (AI), play a vital role in facilitating differentiated support for Sustainable Development Goals (SDGs) within the classroom. AI empowers personalized learning experiences, automates administrative tasks, and provides data-driven insights that ultimately contribute to improved educational outcomes for students from diverse backgrounds (Singh et al., 2024).

While learning technologies offer significant potential in supporting SDGs, challenges such as inadequate teacher training, unequal access to technology, and the need for comprehensive professional development

programs must be addressed to realize their benefits fully. Additionally, ethical considerations and data privacy are crucial in the responsible implementation of AI and other technologies in education (Animashaun et al., 2024; Gupta, 2023; Varriale et al., 2024; Yadav & Sheoran, 2024).

4. Conclusion

Based on the results of this study, this application has very good potential for supporting differentiated learning processes. This application helps teachers identify students' needs and creates learning materials, provides feedback, and creates an inclusive learning environment. The smart teacher application has opened new opportunities in the world of education. This application allows teachers to track students' initial abilities and learning styles in real-time. This information is valuable for designing learning tailored to students' needs. Thus, the learning process can take place more effectively and sustainably. More research is required to understand the smart teacher application's sustainability and long-term effects. Ensuring that this technology can be utilised to its full potential to raise educational standards is the aim.

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