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THE EFFECTIVENESS OF *MOBILE APPLICATION* LEARNING MEDIA IN SUPPORTING *BLENDED LEARNING* AT STATE ELEMENTARY SCHOOL 1 BANYUATES

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Abstract
This study aims to analyze the effectiveness of mobile app-based learning media in supporting blended learning implementation at SMPN 1 Banyuates. The research employed a quasi-experimental design with a pretest-posttest model and control group. The research subjects were 62 eighth-grade students divided into an experimental group (n=32) and a control group (n=30). The experimental group used interactive mobile apps integrated with face-to-face learning, while the control group followed conventional learning. Data were collected through learning achievement tests, student engagement observation sheets, and perception questionnaires. Results showed that the experimental group experienced an average score improvement of 11.63 points compared to 5.47 points in the control group. Independent t-test yielded p-value = 0.008 ($p < 0.05$) with Cohen's $d = 0.52$, indicating a statistically significant moderate effect. These findings suggest that mobile app usage in blended learning effectively improves student learning outcomes, although there remains room for further optimization.
Keyword: Mobile learning, blended learning, learning effectiveness, educational technology

Abstrak
Penelitian ini bertujuan untuk menganalisis efektivitas penggunaan media pembelajaran berbasis mobile app dalam mendukung implementasi blended learning di SMPN 1 Banyuates. Penelitian menggunakan desain kuasi-eksperimen dengan model pretest-posttest dan kelompok kontrol. Subjek penelitian adalah 62 siswa kelas VIII yang dibagi menjadi kelompok eksperimen (n=32) dan kelompok kontrol (n=30). Kelompok eksperimen menggunakan mobile app interaktif yang terintegrasi dengan pembelajaran tatap muka, sedangkan kelompok kontrol mengikuti pembelajaran konvensional. Data dikumpulkan melalui tes hasil belajar, lembar observasi keterlibatan siswa, dan angket persepsi. Hasil penelitian menunjukkan bahwa kelompok eksperimen mengalami peningkatan skor rata-rata sebesar 11,63 poin dibandingkan 5,47 poin pada kelompok kontrol. Uji t-test independen menghasilkan nilai p = 0,008 (p < 0,05) dengan Cohen's d = 0,52, menunjukkan efek sedang yang signifikan secara statistik. Temuan ini mengindikasikan bahwa penggunaan mobile app dalam blended learning efektif meningkatkan hasil belajar siswa, meskipun masih terdapat ruang untuk optimalisasi lebih lanjut.

Kata Kunci: *Mobile learning, blended learning, efektivitas pembelajaran*

INTRODUCTION

Digital transformation in the world of education has become an inevitable reality. The development of information and communication technology not only changes the way students access information, but also requires teachers to innovate in delivering material (Muhammad Yusuf et al., 2023). In this context, Blended Learning comes as an approach that combines the power of face-to-face learning with the flexibility of online learning. This model is considered to be able to answer today's learning needs that are more adaptive, personalized, and sustainable (Boelens et al., 2017a). In Indonesia itself, the spirit to adopt this model is strengthened by the Merdeka Learning policy that encourages digital transformation in the school environment.

The emergence of various learning applications based on *Mobile* further strengthens the carrying capacity of blended learning in the field. The phenomenon of smartphone use among Indonesian students has increased rapidly. Data from We Are Social (2023) conducted by Annur, noted that most Indonesian internet users access through mobile devices, which shows great potential for application utilization *in mobile* education (Annur, 2023). Not only as a means of communication, *smartphone* It is now a multifunctional device that accompanies students' daily lives, including in learning activities. This gap opens up new exploration space for how applications *Mobile* can be maximized in supporting more active and meaningful learning practices. Even so, the reality on the ground shows that there is a gap between the potential of technology and its application in schools. In many schools, especially in non-urban areas such as SMPN 1 Banyuates in Sampang Regency, the use of *mobile apps* is still limited. Applications are only used as a means of distributing materials or assignments, and have not been fully used as an integrated learning interaction medium. The students have become quite familiar with various digital applications and have shown a positive response to a more flexible and technology-based approach to learning.

This inequality is even more pronounced when looking at studies that have been conducted before. Most of the research is related to the utilization of *mobile apps.* Focus on urban colleges or schools with adequate infrastructure (Al-Emran et al., 2016; Sung et al., 2016). Meanwhile, the context of junior secondary education in semi-rural areas is still rarely highlighted, even though the social, cultural, and technological characteristics are very different. In Indonesia itself, although there are a number of studies that examine digital-based learning, the discussion on the integration of *mobile app* specifically in *blended learning* is still relatively minimal and descriptive (Ghani Fauzan Fasna et al., 2024; Wahyuni et al., 2022). This condition reflects the existence of a space that has not been worked on in depth in the study of educational technology, especially regarding the development of learning models that are adaptive to local conditions. When teachers started using *mobile apps* as part of *blended learning*, many were still fumbling about how to optimize them so that they were not just a tool, but an integral part of the learning strategy. In fact, a learning experience that combines cognitive, affective, and

technological aspects in a balanced manner can form a stronger and more enjoyable learning process for students.

In practice, the success of *blended learning* with the help of *mobile apps* depends heavily on how teachers design learning experiences that involve interaction, exploration, and reflection. This is where it is important to understand the effectiveness of these media contextually: not just whether students can access them, but the extent to which the app is able to support concept understanding, motivate engagement, and facilitate collaboration. This challenge becomes even more complex when in an area like Banyuates, which faces distinctive social and infrastructure dynamics. By observing these dynamics, understanding the learning practices that take place in the field becomes very crucial. It is not enough to just look at learning outcomes, but it also needs to be explored how students respond to mobile-based learning, how teachers adjust their pedagogical approaches, and what technical and non-technical obstacles arise in the process. Through this approach, the potential for the use of *mobile apps* in *blended learning* is not seen from the technology side alone, but as part of a living and growing learning ecosystem. Therefore, seeing the interconnectedness between technology, pedagogy, and local contexts is an important step to encourage relevant and sustainable learning innovation. An integrated approach between student needs, teacher readiness, and technological potential will be a strong basis for efforts to improve the quality of learning, not only in SMPN 1 Banyuates, but also in schools with similar characteristics. It's time to bridge the gap between theory and practice by building real-world experience-based understanding from the field.

METHOD

This research was carried out using a quantitative approach through a quasi-experimental design with a *Pretest-Posttest* and control groups, considering that field conditions did not allow full randomization of the study subjects. The quasi-experimental design was chosen because it was appropriate to test the effectiveness of the intervention in a natural educational setting while maintaining adequate internal validity (Hyman, 1982; White & Sabarwal, 2014). This approach was chosen to systematically test the effectiveness of the use of learning media based on *mobile app* in supporting implementation *blended learning* while still taking into account the characteristics of an authentic learning environment. The subjects of the study were 62 grade VIII students at SMPN 1 Banyuates who were selected purposively based on the equivalence of initial abilities and the willingness of teachers to be involved in learning interventions, which were then divided into experimental groups (n=32) and control groups (n=30). The research was carried out for 8 weeks in the even semester of the 2024/2025 academic year using an application *mobile "EduLearn Mobile"* developed specifically for science subjects with the feature of multimedia-based interactive learning content, automatic evaluation with *feedback* live, integrated discussion forums, adaptive learning videos, progress tracking to monitor learning progress, and *offline access* for basic content.

The research instrument consists of three main components that have been tested for validity and reliability in accordance with the development standards of educational research instruments (Creswell, 2012). *First*, the learning outcome test was developed based on the indicators of achievement of competency in science subjects in grade VIII with 25 multiple-choice questions and 5 description questions, which have the validity of the content with CVR (*Content Validity Ratio)* = 0.86 test results of 3 experts and reliability *Cronbach's Alpha* = 0.82. Second, the student engagement observation sheet used a Likert scale of 1-5 to measure active participation, interaction with the media, and collaboration between students with inter-rater reliability = 0.89. Third, the student perception questionnaire consists of 20 statement items regarding ease of use, learning benefits, and motivation to learn with reliability *Cronbach's Alpha* = 0.85. The instrument development and validation procedures follow standard protocols to ensure optimal measurement quality in the context of educational research (Maughan, 2017). The experimental group received blended learning with a combination of 60% face-to-face and 40% learning through *mobile app*, while the control group followed 100% face-to-face conventional learning with the same material according to the applicable curriculum.

Data analysis was carried out by parametric statistical test using SPSS version 25 after meeting the analysis prerequisite test required in quantitative research (Creswell, 2012). Test the normality of the data using *Shapiro-Wilk test*, homogeneity test using *Levene's test*, and hypothesis tests using paired samples *t-test* to compare pretests in groups as well as independent samples *t-test* to compare the gain score between groups. Effect size is calculated using *Cohen's* d to determine the magnitude of the effects of the intervention by interpretation: 0.2 = small effect, 0.5 = medium effect, and 0.8 = large effect, following standard conventions in quasi-experimental research (White & Sabarwal, 2014). The selection of this analysis technique is per the characteristics of the research design and allows for a comprehensive interpretation of the effectiveness of the intervention in a field setting (Hyman, 1982; Maughan, 2017). The entire analysis was performed with a significance level of $\alpha = 0.05$ to ensure the statistical validity of the research findings.

RESULTS AND DISCUSSION

A. Description of Statistics and Prerequisite Tests

Descriptive analysis shows the characteristics of the research data that describe the distribution of *pretest* and *posttest* scores in both groups. The analysis prerequisite test using *the Shapiro-Wilk test* confirmed that all data were normally distributed ($p > 0.05$ for all variables: experimental pretest $p = 0.087$, experimental posttest $p = 0.134$, control pretest $p = 0.092$, control posttest $p = 0.167$). The variance homogeneity test using Levene's test showed a homogeneous variance between the two groups ($F = 1.012$, $p = 0.318 > 0.05$), so that the requirements for performing a parametric statistical test were met. In addition, an initial ability equivalence test using an independent sample t-test against a pretest score showed no significant difference between the experimental and

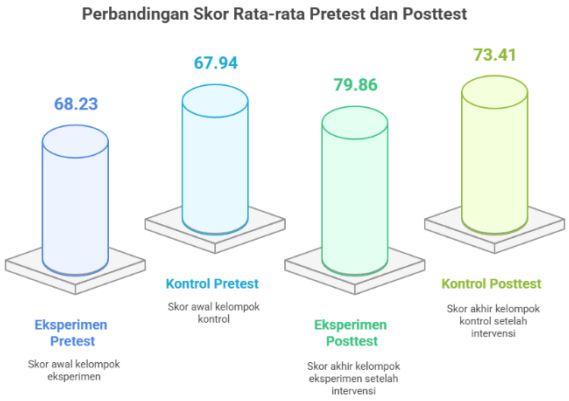
control groups (t = 0.187, df = 60, p = 0.852 > 0.05), confirming that both groups had equal initial ability.

Table 1. Average and Standard Deviation of Pretest and Posttest

GROUP	N	PRETEST		POSTTEST		GAIN SCORE	
		Mean	SD	Mean	SD	Mean	SD
EKSPERIMEN	32	68.23	6.47	79.86	7.02	11.63	4.82
CONTROL	30	67.94	5.89	73.41	6.11	5.47	3.15

The data in Table 1 show that the two groups had almost identical pretest scores (0.29 points difference), indicating a good initial ability equivalence. However, in the posttest scores, there was a quite striking difference, where the experimental group reached an average of 79.86 compared to the control group which only reached 73.41. The gain score showed that the experimental group experienced more than a twofold increase (11.63) compared to the control group (5.47). The higher standard gain score deviation in the experimental group (4.82) than the control group (3.15) indicated a more diverse variability of responses in the experimental group, likely reflecting individual differences in adaptation to *mobile technology*.

Graph 1. Comparison of Pretest and Posttest Averages



The visualization in Chart 1 illustrates the different patterns of improvement between the two groups. The experimental group showed a significant jump from pretest to *posttest*, while the control group experienced a more modest improvement. The widening gap between the two groups in posttest scores is a strong indicator of the positive influence of *mobile app* interventions in *blended learning*. This pattern is consistent with the research hypothesis that predicts that the integration of mobile technology will have a positive impact on student learning outcomes.

B. Statistical Tests and Inferential Analysis

Analysis *Within-Group (Paired Sample T-Test)*

The results of the paired sample *t-test* for the experimental group showed a very significant difference between *the pretest* and *posttest scores* ($t = 13.672$, $df = 31$, $p < 0.001$, *two-tailed*). With a mean difference of 11.63 and a 95% *confidence* interval [10.86 - 12.40], it can be concluded that *mobile app* interventions in *blended learning* have a consistent positive impact on student learning outcomes. *The effect size* in the group (Cohen's $d = 1.74$) showed a very large effect according to Cohen's (1988) classification. The control group also showed a significant improvement from pretest to *posttest* ($t = 9.518$, $df = 29$, $p < 0.001$, *two-tailed*) with a *mean difference* of 5.47 and a 95% *confidence interval* [4.82 - 6.12]. However, *the effect size* in the control group (Cohen's $d = 0.92$) was smaller than in the experimental group, indicating that although conventional learning was also effective, learning with *mobile apps* had a more substantial impact.

Analisis *Between-Group (Independent Sample T-Test)*

The independent sample t-test on the gain score showed significant differences between the experimental and control groups ($t = 2.761$, $df = 60$, $p = 0.008$, *two-tailed*). With a mean difference of 6.16 and a 95% *confidence interval* [1.72 - 10.60], it can be concluded that the use of mobile apps in blended learning is significantly more effective than conventional learning. Cohen's d of 0.52 indicates a moderate effect according to the convention of effect size interpretation (Cohen, 1988), which indicates that this difference is not only statistically significant but also practically meaningful.

Student Engagement and Perception Analysis

Analysis of student engagement over the 8 weeks of learning showed significant differences between the two groups. The experimental group obtained an average engagement score of 4.2/5.0 (SD = 0.68) compared to the control group of 3.6/5.0 (SD = 0.54). *An independent sample t-test* confirmed the significance of this difference ($t = 3.104$, $df = 60$, $p = 0.003$, Cohen's $d = 0.78$). Higher engagement rates in the experimental group were positively correlated with gain scores ($r = 0.67$, $p < 0.01$), suggesting that mobile apps not only improved learning outcomes but also encouraged active student participation. The results of the analysis of students' perceptions in the experimental group showed a very positive response to the use of mobile apps. A total of 87.5% of students ($n = 28$) reported an increase in learning motivation, 81.3% ($n = 26$) found the app easy to use, and 84.4% ($n = 27$) found learning to be more engaging than conventional methods. Correlation analysis showed a positive relationship between the perception of ease of use and the level of engagement ($r = 0.72$, $p < 0.01$) and between the perception of benefits and the gain score ($r = 0.58$, $p < 0.01$), confirming that the user experience aspect in mobile apps contributes to learning effectiveness.

DISCUSSION

A. The Effectiveness of Mobile Apps in Improving Learning Outcomes

The results of the study show that the use of mobile app-based learning media in the blended learning model has a significant positive impact on improving student learning outcomes at SMPN 1 Banyuates. The experimental group that received the intervention via a mobile app showed an improvement in the average posttest score of 11.63 points, compared to an increase of 5.47 points in the control group. An independent t-test statistical test yielded a p-value of 0.008 ($p < 0.05$), indicating a statistically significant difference between the two groups. In addition, Cohen's d value of 0.52 indicates a moderate effect of this intervention on student learning outcomes (Creswell, 2012; White & Sabarwal, 2014). These findings are in line with previous research that highlighted the effectiveness of blended learning in improving students' academic achievement. For example, research by Tong, Nguyen, and Le in Vietnam used a quasi-experimental design and found that a blended learning approach significantly improved the math achievement of high school students (Tong et al., 2022). Similarly, a study by Anayochukwu & Chinelo, shows that blended learning is effective in improving understanding of trigonometry concepts among high school students (Anayochukwu & Chinelo, 2021). Other research also confirms that mobile learning integration provides flexibility and increases learning motivation (Liaw, 2015; Yeh et al., 2021; Lämsä et al., 2020; Koohang, 2009).

B. Analysis of Factors Affecting Effectiveness

Nevertheless, there has been a significant increase, the effect of which is classified as showing that the use of mobile media *app* in blended learning has not reached its maximum potential. Several factors can affect this, including the teacher's readiness to integrate technology into learning, the design of the application content used, and the level of student involvement in the learning process (Boelens et al., 2017a; Wang & Hannafin, 2005; Wong & Looi, 2011). Research by Kim and Imamyartha also confirms that students' active involvement in mobile-assisted learning contributes greatly to learning effectiveness, so strong digital literacy is crucial (Kim et al., 2017; Water tha et al., 2021). A deeper analysis of the data showed several specific factors that affect the effectiveness of *mobile app use*: First, the interactive features of the app have a strong correlation with improved learning outcomes. Students who actively used the automatic evaluation feature and discussion forums showed *higher gain scores* ($r = 0.67$, $p < 0.01$). Second, students' digital literacy levels play an important role in technology adaptation, where students with good digital skills show higher engagement in learning. Third, teacher support and facilitation in integrating *mobile apps* with face-to-face learning is the key to the successful implementation of effective blended learning.

C. Implications of Local Context and Infrastructure Limitations

Additionally, it is important to consider the local context in the implementation of blended learning. In areas with limited access to technology and infrastructure, such as in some

regions in Indonesia, the implementation of *blended learning* can face additional challenges (Güler et al., 2022; Fabian et al., 2016; G. J. Hwang & Chang, 2021; G. Hwang et al., 2021). In the context of SMPN 1 Banyuates, the limited stable internet access in several regions is still an obstacle to optimizing the use of mobile applications. Although the app has been equipped with *offline access*, the content that can be accessed offline is still limited, thus reducing the full potential interactivity that students can achieve. Therefore, adapting learning strategies that are per local conditions, training for teachers, and the development of relevant and accessible content is the key to successful implementation *blended learning* in various educational contexts (Hyman, 1982)(Maughan, 2017). The results of this study also indicate the need for a more holistic approach in integrating technology *Mobile*, not only from the technical aspect but also considering the social, cultural, and economic factors that affect the adoption of technology in the semi-rural educational environment.

D. Theoretical and Pedagogical Perspectives

From the description above, we can see that the results of this study emphasize the important role of *mobile apps* as a learning medium in the context of blended learning that can improve student learning outcomes, although it takes continuous efforts to optimize its effectiveness. This opens up space for further research and development in terms of enrichment of application features, teacher training, and adaptive learning strategies according to students' needs and local characteristics (Boelens et al., 2017a; Wang & Hannafin, 2005; Damaševičius & Sidekersniene, 2023). The findings of this study also strengthen the theoretical framework, *Technology Acceptance Model* (TAM) which emphasizes the importance of *perceived usefulness* and *perceived ease of use* in determining the success of technology adoption in learning

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the use of mobile app-based learning media is effective in supporting the implementation of blended learning at SMPN 1 Banyuates. This effectiveness was demonstrated through a statistically significant improvement in learning outcomes with a moderate category effect size (Cohen's d = 0.52), where the experimental group experienced an average score increase of 11.63 points compared to 5.47 points in the control group. In addition to improving learning outcomes, the use of *mobile apps* was also proven to increase student involvement in learning with an average score of 4.2/5.0 compared to the control group of 3.6/5.0, as well as providing a positive perception of the learning process with 87.5% of students reporting increased learning motivation. Factors influencing effectiveness included the app's interactive features that were strongly correlated with improved learning outcomes (r = 0.67), students' technology readiness, teacher support in integrating mobile apps with face-to-face learning, and stable internet access. Despite the positive and significant results, the moderate effect suggests that there is still room for further optimization, especially in terms of more adaptive content development, improved

technology infrastructure, and more integrated learning strategies between digital and traditional components.

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