

Digitalization of learning media: A comparative study on metacognitive ability, learning interest, and activeness in Islamic High School 2 Banyumas Excellent Class

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ABSTRACT

The growing use of digital learning media calls for a deeper investigation into its effects on students' psychological aspects, particularly metacognitive ability, learning interest, and activeness. It aims to compare students' metacognitive ability, learning interest, and activeness before and after implementing digital learning media. This study focuses on 80 10th-grade students in the Excellent Class at Islamic High School (MAN) 2 Banyumas during the 2023/2024 academic year. Using a descriptive comparative quantitative approach with a survey method, data were collected through non-probability sampling with a saturation (census) technique. The results show significant differences in all three aspects after the implementation. Specifically, students' metacognitive ability improved by 19%, learning interest by 37%, and learning activeness by 31%. These findings confirm that digital learning media have a positive impact on students' learning experiences. It enhances their ability to monitor their learning, increases their engagement, and encourages more active class participation. The results highlight the value of digital tools in supporting modern education. However, further research is needed to identify specific causal factors contributing to these improvements, such as interface usability and the integration of interactive learning features. Additionally, long-term studies are recommended to examine the sustainability of these benefits over time and how digital media can be continually optimized to support student development.



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INTRODUCTION

The technological development in Indonesia has undergone a rapid acceleration, particularly in the context of its digital transformation (Suryawijaya, 2023). Indonesia's performance in the Global Innovation Index (GII) serves as an indicator of the nation's progress in innovation, having exhibited consistent upward movement in its global ranking over the past three years (WIPO, 2023). Maharani & Meynawati (2023) assert that such swift technological advancement possesses the capacity to restructure societal frameworks and exerts profound effects across various domains,



namely the economic, socio-cultural, and educational sectors. The spread of COVID-19 further expedited this technological progression, positioning digital technologies as pivotal instruments in mitigating the challenges imposed by the pandemic (Akbar, 2023). Among the sectors profoundly impacted by COVID-19 was the educational field (Darmawan & Atmojo, 2020). A meta-analysis of studies conducted between 2000 and 2020 indicates that approximately 41% of them demonstrated a positive contribution of online learning to students' academic outcomes, although such findings diverge from earlier research that reported no statistically significant influence on academic achievement (Steven et al., 2021). The digitalization of education has thereby emerged as an unavoidable global phenomenon, deemed essential for maintaining instructional efficacy, efficiency, and relevance to contemporary demands (Hakim & Aziz, 2021). It follows that the realization of digital transformation in education necessitates not only adequate infrastructure and technological solutions but also the deployment of appropriate platforms and tools to support pedagogical delivery (Putri et al., 2021).

The School Digitalization Program initiated by the Ministry of Education, Culture, Research, and Technology through the use of information and communication technology has the hope of facilitating the teaching and learning process, making it easier for teachers and students to access teaching materials and exams, and making it easier for teachers to collaborate in creating daily test materials both offline and online (Firmansyah et al., 2023). Based on the existing phenomenon and supported by the School Digitalization Program, Islamic High School (MAN) 2 Banyumas took real steps by initiating the first digital class or excellent class in Banyumas Regency since the 2022/2023 academic year. The purpose of Islamic High School 2 Banyumas in providing this class is to familiarize students with digital-based learning so that students are more interested in learning. This statement is in line with research by Iskandar et al., (2022), which states that the digitalization of learning media will make students more enthusiastic in participating in ongoing learning, and can increase students' curiosity so that students are more creative and critical. Based on initial observation data, it was found that there were differences in students' attitudes towards digitalization between the leading class XI (Mathematics and Natural Sciences 1 and Social Science 1) and the leading class X (Research and Science). It was found that 71% of 10th-grade students in the Excellent Class reported feeling unfamiliar with the implementation of digital learning media facilitated by the school. In contrast, 81% of 11th-grade students in the same program stated that they were already familiar with such digitalization. This unfamiliarity among 10th-grade students may be attributed to several factors. As new students enrolled in the Excellent Class (Research and Science tracks), many had no prior experience with the program. Additionally, teachers often did not utilize the available digital facilities; their previous classrooms lacked adequate infrastructure, and the learning media previously employed were primarily conventional. These findings are consistent with the research by Diana & Rofiki (2020), which suggests that students' low receptiveness to technology in the learning process is influenced by several factors, including teachers' lack of technological competence, insufficient tools and infrastructure, and learning processes that are not aligned with technological developments.

According to Sarie et al., (2023), one of the reasons why students' psychological aspects, which determine the success of the learning process, are not well-implemented is the continued use of conventional teaching methods without being accompanied by proper development in the digitalization of learning media. This is supported by research from Jariyah & Ummah (2022), which states that the rapid development of the digital era must be balanced with students' abilities that enable them to develop their ways of facing various challenges. Isma et al., (2022), explain that when schools implement digitalization of learning media, the effort aims to help students learn through technology so they become familiar with it, meet the increasing demand for knowledge, improve the quality of learning, and equip students with critical, creative, communicative, and collaborative skills. In terms of definition, metacognitive ability, according to Lestari et al., (2019), is students' awareness in understanding how they learn, being able to evaluate the problems they face, identify their level of self-understanding, utilize various resources, and assess their learning progress.

Perdana et al., (2022) state that the learning process utilizing digital media can lead to improvements in students' metacognitive abilities, enabling them to manage and respond effectively to the digitalization facilitated by schools. In addition to enhancing metacognitive skills, one of the

goals of Islamic High School 2 Banyumas in providing excellent classes is to increase students' interest in learning. Hemayanti et al., (2020) argue that the learning process is also influenced by other psychological aspects of students, such as motivation, interest, activeness, talent, and intelligence, so the digitalization of learning media facilitated by the school contributes significantly to the success of the learning process. According to Kamaruddin (2022), one way to attract students' interest in classroom learning is to provide a variety of learning models, particularly interactive digital-based learning, which has been proven to have a positive impact on students. Students who have a strong interest in learning will tend to show greater activity in learning, which contributes to a more effective learning process (Farisi et al., 2023). Prasetyo & Abduh (2021) define learning activity as students' efforts to develop their potential through learning activities. Based on research by Reinita & Putri (2024), digital-based learning media such as digital modules are highly effective in the learning process and have great potential to help teachers facilitate students' understanding of the material while also increasing their participation, motivation, and activeness.

This study aims to analyze the differences in metacognitive ability, learning interest, and learning activeness of students in the Excellent Class of Research and Science (Grade X) at Islamic High School 2 Banyumas by comparing their conditions before and after being exposed to the digitalization of learning media implemented by the school. The literature indicates that although the adoption of educational technology is increasingly widespread, comparative studies that explore changes in these psychological aspects among the same students, specifically in the context of transitioning to a digitized excellent classroom environment using non-intervention survey data, remain very limited. Existing research generally focuses on experimental approaches with artificial treatments or momentary descriptive surveys. Therefore, this study is highly relevant and impactful, providing concrete empirical evidence as a foundation for the development of technology-based educational policies, a driver of innovation in learning media design, and a catalyst to raise stakeholders' awareness of the critical importance of digitalization for holistic learning quality. Direct comparative survey data from students also offers valuable insights for designing responsive learning environments in the digital era.

METHOD

This research is a descriptive comparative study using a quantitative approach. According to Paramita et al., (2021), descriptive research can provide an empirical overview or description of the data collected in a study. Meanwhile, Sugiyono (2019) explains that comparative research aims to compare the values of one or more independent variables across two or more populations, samples, or different or combined periods. The approach used in this study is a quantitative approach, which is based on numerical or statistical data (Suliyanto, 2018).

The population of this study consists of 80 students from the Grade X Excellent Class of Research and Science. The sampling technique used is total sampling (census). The characteristics of the respondents based on gender can be seen in the following Table 1.

Table 1. Respondent Characteristics Based on Gender

No.	Gender	Students Total	Percentage (%)
1	Male	19	23.75
2	Female	61	76.25
Total		80	100

Source: Primary data, processed in 2024

The table above shows that the research respondents were predominantly female, totaling 61 students or 76.25%, while the remaining 23.75% or 19 students were male. Suliyanto (2018) states that saturated sampling is used when the entire population is selected as the sample due to the relatively small population size (200 or fewer). Based on the total population in this study, the sample was determined using a non-probability sampling technique, consisting of 80 students.

Data collection was carried out using a closed-ended questionnaire with a Likert scale. The questionnaire data were then transformed into interval data using the Method of Successive Intervals (MSI) with the help of Microsoft Excel, in addition to interviews and documentation. All research

data were analyzed using SPSS version 26 for Windows. The Likert scale used in this study ranged from 1 to 4, deliberately omitting the neutral midpoint.

Data collection was conducted using two sets of questionnaires distributed in a single session. These questionnaires were designed to compare students' experiences before entering the excellent class with their conditions afterward, particularly about their exposure to the digitalization of learning media implemented by the school. The questionnaire instrument specifically measured three main variables: metacognitive ability, learning interest, and learning activeness. The research indicators can be seen in the following Table 2.

Table 2. Research Indicator

No.	Variables	Indicators
1	Metacognitive Ability	1. Students are aware of their thinking processes and can describe them; 2. Students can develop recognition of thinking strategies; 3. Students can reflect on procedures evaluatively; 4. Students can transfer knowledge and experiences to other contexts; 5. Students can connect conceptual understanding with procedural experiences. (Iskandar, 2014)
2	Learning Interest	1. A sense of enjoyment in learning activities; 2. Focus and concentration on learning; 3. Willingness to learn; 4. Intrinsic motivation to actively participate in learning; 5. Efforts made to realize the desire to learn. (Friantini & Winata, 2019)
3	Learning Activeness	1. Students pay attention to the teacher's explanation; 2. Students ask questions; 3. Students respond to questions; 4. Students engage in group discussions; 5. Students take notes summarizing lesson materials; 6. Students express ideas or thoughts; 7. Students present group work results. (Prasetyo & Abduh, 2021)

The data collection procedure involved asking students to reflect on and review their conditions before becoming students in the Grade X Excellent Class and then to review their conditions after being in the digitally integrated Excellent Class. This study is purely observational, focusing on students' perceived differences as a natural response to their new learning environment and their adaptation to the implementation of digitalized learning media. The data from both sets of questionnaire reflections were then compared to identify differences across the three variables.

The collected data were tested for validity using Pearson's product-moment correlation analysis. The criteria for determining validity are as follows: if the calculated correlation coefficient $r_{\text{calculated}} \geq r_{\text{table}}$, the data are considered valid; and if $r_{\text{calculated}} < r_{\text{table}}$, the data are considered invalid.

Furthermore, a reliability test was conducted to assess the stability and consistency of respondents in answering the research questions (Sujarweni, 2021). The reliability test employed Cronbach's Alpha analysis, with the following criteria: if the Cronbach's Alpha value is ≥ 0.60 , the data are considered reliable; if the Cronbach's Alpha value is < 0.60 , the data are considered unreliable. The validity and reliability tests were conducted on a group of 33 students from the Grade XI Excellent Class in the Science Program (MIPA), who were not part of the research sample.

After the data were deemed valid and reliable, the next step of analysis involved conducting a normality test on the research data from the sample. The reason the researcher used only a normality test is that the analysis in this study requires only the assessment of the data distribution. According to Setiawan & Yosep (2020), a normality test is used to determine whether the sample data come from a population that is normally distributed. This was tested using the Kolmogorov-Smirnov method, with the following criteria: if the p-value or Sig. > 0.05 , the sample data are considered normally distributed; if the p-value or Sig. ≤ 0.05 , the sample data are not normally distributed.

To analyze whether there are differences before and after the implementation of digitalization of learning media in the Grade X Excellent Class, the researcher employed a difference test (comparative test) to conclude. A difference test is a comparative or statistical analysis technique used to identify differences between two or more data groups (samples), whether the groups are related or independent (Wulansari, 2023). This study used a paired sample difference test, with the assumption that the data may be normally or non-normally distributed. If the data are normally distributed, the analysis is conducted using the paired t-test; if the data are not normally distributed, the Wilcoxon signed-rank test is used (Lind et., 2024).

RESULT AND DISCUSSION

Result

Validity Test

Based on the responses from 33 students in the Grade XI Excellent Class (MIPA) and a significance level (α) of 5%, the r-table value was determined to be 0.344. It was found that among the 20 items in the metacognitive ability variable, 1 item was deemed invalid; among the 20 items in the learning interest variable, 1 item was also deemed invalid; and among the 28 items in the learning activeness variable, 2 items were found to be invalid. An item was considered invalid if its r-calculated value was lower than the r-table value. Therefore, these invalid items were excluded from the main data collection process of the research.

Reliability Test

All instruments for each variable obtained a Cronbach's Alpha value ≥ 0.60 . Therefore, the items in the questionnaires for the variables of metacognitive ability, learning interest, and learning activeness can be considered reliable. The reliability results are presented in the following Table 3.

Table 3. Reliability Test Result

No.	Variables	Alpha Cronbach		Reliability Standard	Notes
		Before	After		
1	Metacognitive Ability	0.884	0.806	0.60	Reliable
2	Learning Interest	0.846	0.736	0.60	Reliable
3	Learning Activeness	0.907	0.859	0.60	Reliable

Source: Primary data, processed in 2024

Normality Test

The normality test was used as a prerequisite and determinant for the selection of the appropriate analytical tool in this study. The results of the normality test, as shown in Table 4, indicate that the p-value (Sig.) is less than 0.05. Therefore, the data for all three variables are considered not normally distributed, and the analysis was carried out using the Wilcoxon signed-rank test, as presented in Table 6.

Table 4. Normality Test Result

No.	Variables	Before the Digitalization of Learning Media	After the Digitalization of Learning Media	Result
1	Metacognitive Ability	0.004	0.034	Not Normal
2	Learning Interest	0.012	0.005	Not Normal
3	Learning Activeness	0.000	0.010	Not Normal

Source: Primary data, processed in 2024

Hypothesis Test

A hypothesis test was conducted using Wilcoxon signed-rank analysis, with the formulation of the research hypotheses as follows, as shown in Table 5.

Table 5. Hypothesis Formulation

No.	Variables	Hypothesis _a	Hypothesis _b
1	Metacognitive Ability	There is a difference in the metacognitive ability of Grade X Excellent Class students at Islamic High School 2 before and after the digitalization of learning media.	There is no difference in the metacognitive ability of Grade X Excellent Class students at Islamic High School 2 Banyumas before and after the digitalization of learning media.
2	Learning Interest	There is a difference in the learning interest of Grade X Excellent Class students at Islamic High School 2 before and after the digitalization of learning media.	There is no difference in the learning interest of Grade X Excellent Class students at Islamic High School 2 Banyumas before and after the digitalization of learning media.
3	Learning Activeness	There is a difference in the learning activity of Grade X Excellent Class students at Islamic High School 2 Banyumas before and after the digitalization of learning media.	There is no difference in the learning activity of Grade X Excellent Class students at Islamic High School 2 Banyumas before and after the digitalization of learning media.

The criteria for the Wilcoxon signed-rank test are as follows: if the Asymp. Sig. (2-tailed) < 0.05, it indicates a significant difference; whereas if the Asymp. Sig. (2-tailed) ≥ 0.05, it indicates no significant difference. The Wilcoxon test is used to examine the difference between two correlated samples when the assumption of normality is not met. The results of the Wilcoxon test, as shown in [Table 6](#), indicate that the Asymp. Sig. (2-tailed) values for all three variables are less than 0.05, which suggests that there is a significant difference in the mean values before and after the digitalization of learning media for each of the three variables

Table 6. Wilcoxon Test Result

No.	Variables	Asymp. Sig. 2 tailed	Result
1	Metacognitive Ability	0.000	There is a Difference
2	Learning Interest	0.000	There is a Difference
3	Learning Activeness	0.000	There is a Difference

Source: Primary data, processed in 2024

Discussion

Comparative Analysis of Metacognitive Ability Before and After the Digitalization of Learning Media

The results of the Wilcoxon signed-rank test indicate that there is a significant difference in the metacognitive ability of Grade X Excellent Class students (consisting of the Riset and Science Class) at Islamic High School 2 Banyumas before and after the digitalization of learning media. The mean score of respondents' answers regarding metacognitive ability was 22.20 before the implementation of digitalized learning media and 26.34 after the implementation. The difference between the two mean scores is 4.14, indicating an increase of approximately 19% in the average metacognitive ability score after digitalization. [Bintang et al., \(2020\)](#) found in their study that students who used digital learning media demonstrated better metacognitive ability compared to those who did not use such media during learning. Similarly, [Erayani & Jampel \(2022\)](#) concluded that interactive learning media can enhance or positively influence students' metacognitive abilities and learning interest. This is further supported by [Perdana et al., \(2022\)](#), who also stated that students reported a noticeable improvement in their metacognitive skills after using digital learning media. Based on these previous findings and the results of the present study, it can be concluded that the digitalization of learning media, as facilitated by the school for Grade X Excellent Class students,

has proven beneficial in helping students develop the ability to understand, control, and regulate their thinking processes—thereby encouraging more critical and creative learning.

Comparative Analysis of Learning Interest Before and After the Digitalization of Learning Media

The results of the Wilcoxon signed-rank test show that there is a significant difference in the learning interest of Grade X Excellent Class students (consisting of the Riset and Science Class) at Islamic High School 2 Banyumas before and after the digitalization of learning media. The average score of respondents' answers regarding learning interest was 22.70 before the implementation of digitalized learning media and 31.13 after the implementation. The difference between these mean scores is 8.43, indicating an increase of approximately 37% in the average learning interest after the integration of digitalized media in the classroom. [Hafzah et al., \(2020\)](#) explained that the use of digital media in learning makes the classroom environment more effective, interactive, and engaging, thereby encouraging students to develop a stronger and growing interest in learning. [Khairunnisa & Aziz \(2021\)](#) concluded in their study that the implementation of digital learning media tailored to specific subject needs can significantly improve students' interest in learning. Similarly, stated that students' learning interest can vary positively when digital learning media are used. Based on previous research and the findings of this study, it can be concluded that the digitalization of learning media, as facilitated by the school for the Grade X Excellent Class, has proven beneficial in creating a dynamic learning environment and providing opportunities for students to explore their interests and talents more deeply.

Comparative Analysis of Learning Activeness Before and After the Digitalization of Learning Media

The results of the Wilcoxon signed-rank test show that there is a significant difference in the learning activity of Grade X Excellent Class students (consisting of the Riset and Science Class) at Islamic High School 2 Banyumas before and after the digitalization of learning media. The average score of respondents' answers related to learning activity was 31.41 before the digitalization of learning media and 41.20 after its implementation. The difference between these two means is 9.79, indicating an increase of approximately 31% in the average learning activeness score demonstrated in their study that students' learning activeness significantly improved when the learning materials were combined with digital learning media in the form of games. This integration helped create an engaging learning atmosphere and enabled effective two-way communication between teachers and students. Furthermore, [Aini et al., \(2022\)](#) concluded that there was a noticeable difference in the average level of learning activity before and after using digital learning media in the classroom. Similarly, [Yanti et al., \(2023\)](#) stated that digital learning media positively influenced classroom activeness and increased students' enthusiasm in participating in the learning process. Based on previous studies and the findings of this research, it can be concluded that the digitalization of learning media, as facilitated by the school for Grade X Excellent Class students, has provided clear benefits. It promotes a productive two-way interaction between teachers and students, fosters a more engaging and less monotonous learning environment, and stimulates students to participate actively during lessons according to their individual learning preferences.

CONCLUSION

Based on the results and discussion of the research, it can be concluded that: (1) students metacognitive ability increased by 19% after entering the excellent class and implementing the digitalization of learning media; (2) this study found a difference in students learning interest in Grade X Excellent Class at Islamic High School 2 Banyumas before and after the digitalization of learning media, amounting to 37%; (3) a difference in students learning activeness in Grade X Excellent Class at Islamic High School 2 Banyumas was also found before and after the digitalization of learning media, amounting to 31%, after students entered the excellent class and experienced the implementation of digitalized learning media.

This study implies that the digitalization of learning media implemented at Islamic High School 2 Banyumas has contributed to the improvement of metacognitive ability, learning interest,

and learning activeness of Grade X Excellent Class students in the 2023/2024 academic year. This finding indicates that the use of technology in education offers several benefits, including: (1) assisting in the development of students ability to understand, manage, and regulate their learning processes; (2) affirming that technology can stimulate students interest in learning; (3) showing that technology-based learning approaches can be a key factor in motivating students to learn with greater enthusiasm and engagement; (4) highlighting that interactivity and the diversity of resources available in digital media encourage students to be more actively involved in the learning process. As for recommendations for future research, it is suggested to identify specific triggering factors within the digitalization of learning media that most significantly contribute to the enhancement of metacognitive ability, learning interest, and activeness. Furthermore, longitudinal studies are recommended to monitor the sustainability of these impacts over the long term.

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