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Effectiveness of Nearpod-Based Interactive Learning Media in Enhancing Students' Scientific Literacy and Numeracy in Renewable Energy Topic

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Abstract: The inadequate science literacy and numeracy levels of class X students in the 2021/2022 academic year at SMA Negeri 1 Ajibarang in physics learning, particularly in the domain of renewable energy materials, can be attributed to the limited engagement of science literacy and numeracy in the available learning media. The internet's potential as a learning tool has not been maximally utilized, resulting in a suboptimal learning experience for Generation Z students. In addition, some digital platforms commonly used by teachers are still not optimal in accommodating learning due to several weaknesses, such as limited material and interactive features, as well as information that is prone to being missed during the online discussion process through chat. These problems can be solved by utilizing Nearpod-based interactive learning media. This study aims to analyze the effectiveness of the media and compare which media exploration is considered most effective in enhancing students' science literacy and numeracy. The study employed a pre-experimental approach, utilizing a pre-test and post-test design with three experimental groups. The results indicated that experimental groups A, B, and C enhanced science literacy and numeracy. The N-gain scores of these groups were classified as 'low', with N-gain scores of 0.15, 0.13, and 0.07, respectively, for experimental groups A, B, and C regarding science literacy. The numeracy literacy of experimental groups A, B, and C were 0.20, 0.18, and 0.01, respectively. The conclusion drawn from these data is that Nearpod media is effective in enhancing science literacy and numeracy in the context of renewable energy, especially in the explanation of scientific phenomena in science literacy and the utilization of concepts, facts, procedures, and reasoning in mathematics in numeracy literacy. The utilization of Nearpod in blended learning is more efficacious than its use in flipped learning and print, with an N-gain value of science literacy and numeracy.

Keywords: nearpod, science literacy skills, physics numeracy literacy, renewable energy.

▪ INTRODUCTION

The global pandemic of Coronavirus Disease 2019 (henceforth referred to as "COVID-19") has had a significant impact on education systems worldwide. One of the major adaptations made by educational institutions in response to the pandemic has been the rapid transition from traditional, face-to-face learning to online learning (Giday & Perumal, 2024). These changes have given a significant boost to the rapid development of digital technologies in education during the pandemic (Palumbo, 2022). Consequently, numerous teaching-learning activities that were previously carried out conventionally have now been digitized (Tiwari et al., 2021).

The strategy implemented to facilitate online learning during the pandemic has not been effective in enhancing student comprehension, as evidenced by Alzahrani's (2022) findings. The study indicated that students demonstrated a higher level of performance in online learning compared to traditional learning methods. However, Khoirunnisa & Adirakasiwi's (2023) research revealed that seventh-grade students' numeracy literacy in

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the Merdeka Belajar era was found to be significantly low at 37%. Similarly, Melinda et al. (2021) found that students' science literacy skills in Physics class were in the low category, with a percentage of 28.38%.

Based on a survey conducted with one of SMA Negeri 1 Ajibarang's physics teachers, almost all Grade X students in 2021/2022 had difficulties in mathematics analysis, data presentation and interpretation, and short answer questions without evidence in physics learning, including renewable energy. This indicates that the level of students' scientific literacy and numeracy skills remains below satisfactory levels. Teachers' difficulties in teaching physics concepts involving scientific literacy and numeracy related to renewable energy materials are reflected in students' weak decision-making skills. As Østergaard et al. (2022) point out, almost all aspects of life depend on energy, and understanding renewable energy is important as part of sustainable development efforts.

Technological advances during the pandemic have resulted in the development of several new habits in the post-pandemic period, including the learning process, which is now dependent on the use of technology and other assistive devices (Ramadhan et al., 2021). The generation of today's learners (Generation Z) is growing up in a digitally connected world where information can be accessed immediately with the help of practical and sophisticated tools such as smartphones, tablets, and laptops (Green et al., 2021). These devices potentially facilitate integrating interactive platforms into classroom learning ((Martín-Sómer et al., 2024). The integration of technology in learning offers immediate feedback, encourages interaction, and supports diverse learning needs, potentially improving student engagement and learning outcomes (Priante & Tsekouras, 2025). In response, one of the efforts that can be made to rebuild students' understanding of a concept that involves science and numeracy literacy is to combine face-to-face learning with technology as a digitally based learning medium with a science and numeracy literacy approach.

Some digital platforms such as WhatsApp group (Natale et al., 2021; Syarifuddin et al., 2024), Quizizz (Agustia et al., 2020; Saefurohman et al., 2023), Canva (Oktariya et al., 2023; Wumu et al., 2023), Google Classroom (Rosa et al., 2023; Fitriyanasari et al., 2022), and Nearpod can be used as learning media to improve scientific literacy and numeracy. However, the teaching and learning process can be hindered by some of the weaknesses of these platforms. These weaknesses such as important information via WhatsApp group chat tends to get lost in students' responses during discussions (Mustakim, 2020), the material presented is still limited to Quizizz (Mujahidin et al., 2021), some templates and features are paid on Canva (Idawati et al., 2022), Google Classroom features are still limited (Nurhayati et al., 2019) such as the unavailability of live chat features and interactive quizzes (Hasiru et al., 2021).

In response to the limitations of earlier digital platforms, Nearpod is regarded as a potential solution to address these weaknesses. Nearpod is a digital tool that enables teachers to create engaging and interactive presentations using multimedia, video, audio, sketches, virtual reality tours, games, and quizzes directly on the Nearpod website. The platform provides real-time formative assessment with feedback, allowing students to immediately reflect on their learning. Furthermore, Nearpod assists teachers in monitoring students' progress, identifying material requiring further attention, and swiftly highlighting it (Alawadhi & Thabet, 2022). The platform is available for download from

the Play Store (OS 8.0 or higher) or the App Store (IOS 15.0 or higher) and can also be accessed directly from the website.

Despite Nearpod's numerous advantages for creating interactive learning materials, there is a paucity of research on its use in physics education. A review of the literature from the past decade reveals only nine articles that report the use of Nearpod in physics learning, including those on Hooke's Law (Fanika et al., 2022) static fluid (Rahmani, 2022), Parabolic Motion (Qiao, 2022), Newton's gravity (Sudiar et al., 2023), Hydrostatic and Archimedes' Law (Putri, 2024), Direct Current (Della, 2024), and Light (Kurniawati, 2024). In addition, other studies utilized Nearpod to determine the generative thinking of grade V students in physics learning (Al-fatlawi & Al-Musawi, 2022) and the impact of video games on physics learning (Yuan et al., 2022). The utilization of Nearpod to enhance science literacy and numeracy remains unexamined within the Indonesian context. Previous studies have exclusively examined the impact of Nearpod in assessing specific facets of science literacy or numeracy. Nonetheless, Nearpod is an effective tool for enhancing science literacy within the context of science subjects (Ulinnuha, 2023; Davey et al., 2020) and environmental change (Saragi et al., 2025). Furthermore, Nearpod is reported to enhance numeracy literacy (Brown, C, 2019), particularly in the context of understanding and applying mathematical concepts in everyday life (Wilson, 2020).

The development of Nearpod as a learning media for the enhancement of science literacy and numeracy must be informed by a series of preparatory requirements. According to the OECD (2017), competencies in science literacy encompass the ability to explain phenomena from a scientific perspective, evaluate and design scientific investigations, and interpret data and evidence scientifically. The level of cognitive process of numeracy literacy includes (1) formulating problems mathematically, (2) using concepts, facts, procedures, and reasoning in mathematics, and (3) interpreting, applying, and evaluating the results of a mathematical process (OECD, 2017).

This study aims to analyze the effectiveness of Nearpod-based interactive renewable energy physics learning media in enhancing science literacy and numeracy skills. The study was designed to allocate students in three experimental groups with different treatments, including the use of Nearpod in blended learning, the use of Nearpod in flipped learning, and the use of Nearpod in print with the assistance of QR codes. The study's experimental design is based on the hypothesis that these media are equally effective in enhancing students' science literacy and numeracy skills. The overarching objective of this study is to provide a comprehensive response to the following research question using a comparative exploration of media utilization:

RQ1: Is there a significant comparison of students' science literacy and numeracy skills between groups (blended learning group, flipped learning group, and printed group) in physics learning?

RQ2: Which media exploration is most effective in improving students' science literacy and numeracy?

It is hypothesized that the results of this study will enhance students' science literacy and numeracy, particularly concerning the subject of renewable energy. Furthermore, it is predicted that the study will facilitate students' multiple intelligence following Howard Gardner's learning theory, known as the Multiple Intelligences Theory (Loveless, 2023).

The utilization of media has also been demonstrated to facilitate the integration of technology as a learning medium in its own right.

▪ METHOD

Participants

The population of this study consisted of class X students at SMA Negeri 1 Ajibarang, in the even semester of the 2023/2024 academic year. The purposive sampling method was used to select the sample, with class selection based on recommendations from physics teachers, who provided input based on the level of student activeness. This approach resulted in a total sample of 108 students, consisting of classes X-1 (36 students), X-4 (36 students), and X-7 (36 students).

Research Design and Procedures

The research adopts a quantitative approach, employing a pre-experimental design with a three-group pre-test post-test model. The research model consists of three distinct phases: a pre-test phase, an implementation phase, and a post-test phase. The study was initiated with a 45-minute pre-test questionnaire completed by the entire sample to ascertain the students' initial abilities. Subsequently, the media was implemented in each experimental group for a duration of 4 x 45 minutes. The experimental groups were divided into three distinct groups: experimental group A (X-1), experimental group B (X-4), and experimental group C (X-7). The media utilized by each group varied as follows: Nearpod media was used during the learning process (blended learning) by experimental group A; Nearpod media was used before learning (flipped learning) by experimental group B; and Nearpod media was provided in printed form, accompanied by a QR code, by experimental group C. The Nearpod media is initiated with the presentation of videos, which elicit responses from students through the provision of questions embedded within the video content. After the explanation of the material by the researcher (as a teacher), students are tasked with completing an interactive quiz. Additionally, students are encouraged to utilize PheT Simulations to perform physics simulations, analyze the results, and present their findings in a group setting. All student activities and learning outcomes can be accessed directly on the media, while students who use printed Nearpod's can be accessed through printed Nearpod sheets and Google Forms. The final stage of this research is a post-test conducted by the entire sample to measure the final ability of students after media implementation.

Instrument

The instruments utilized in this study encompass both test and non-test instruments. The test instruments, in the form of pre-test and post-test, were employed to assess students' science literacy and numeracy levels before and following the implementation of media. The non-test instruments comprised validity and reliability questionnaires. The test instruments, encompassing both pre-test and post-test, comprised a total of 12 multiple-choice questions and six essay questions, which underwent rigorous validity and reliability assessments before utilization. The validity test demonstrated the questions to be valid, while the reliability test indicated their reliability with high criteria. The items were arranged based on indicators of the competency aspects of science literacy and aspects or cognitive levels of numeracy literacy. Indicators of the competency aspects of science literacy include: (1) explaining scientific phenomena (LS 1), (2) interpreting data

and evidence scientifically (LS 2), and (3) evaluating and designing scientific investigations (LS 3). The indicators on the cognitive aspect or level are as follows: (1) formulate mathematical situations (LN 1), (2) use mathematical concepts, facts, procedures, and reasoning (LN 2), and (3) interpret, apply, and evaluate mathematical results. Each indicator was represented by two multiple-choice items and one essay item (LN 3).

Data Analysis

The data analysis techniques used in this study were executed using SPSS software version 26.0, encompassing a range of tests from the requirement test to the effectiveness test. The initial test comprises the assessment of normality (using the Shapiro-Wilk statistical test) and homogeneity (using the Levene statistical test). The data analyzed, using a significance level of $\alpha = 5\%$ (0.05), comprised the pre-test and post-test results of the three experimental groups, which had previously been evaluated. This study uses both parametric (normally distributed data) and non-parametric (non-normally distributed data) statistical tests to assess the effectiveness of media usage in enhancing science education outcomes. The parametric statistical test utilized is the paired sample t-test, while the non-parametric test employs the Wilcoxon test. A notable similarity exists between these tests; both are employed to ascertain whether differences in student learning outcomes occur before and after the implementation of media-based education. The distinguishing factor lies in the data that is analyzed. The outcomes of the data analysis, incorporating both parametric and non-parametric statistical tests, are juxtaposed with a significant value of $\alpha = 5\%$ (0.05). The hypothesis is posited that in instances where the outcomes of the data analysis exceed 0.05, no evidence of students' abilities changing before and following media utilization is observed. Conversely, if the outcomes of the data analysis fall below 0.05, a discrepancy is indicated in the student's abilities before and after media engagement. The effectiveness of media is determined by analyzing the enhancement of science literacy competency aspects, alongside the level or cognitive process of numeracy literacy. The calculation of N-gain values is performed using the formula outlined by Hake (Sembiring & Napitupulu, 2022), with the criteria for N-gain scores categorized as follows: high category if $\langle g \rangle > 0.7$, medium category if $0{,}3 \leq \langle g \rangle \leq 0{,}7$, and low category if $\langle g \rangle < 0.3$ (Rosidah et al., 2022).

▪ RESULT AND DISSCUSSION

This study examined the effectiveness of Nearpod-based interactive physics learning media in enhancing students' science literacy and numeracy skills. The pre- and post-test results were analyzed using a range of assessments, including the pre-requisite test, the effect test, and the N-gain test. The normality of the pre-test and post-test scores of students in experimental groups A, B, and C is presented in Table 1.

Table 1. Experimental groups normality test results

No.	Score	Shapiro-Wilk Significant	Description
1.	Pre-test of experimental group A	0.052	Normally Distributed
	Post-test of experimental group A	0.088	Normally Distributed
2.	Pre-test of experimental group B	0.001	Not Normally Distributed

	Post-test of experimental group B	0.019	Not Normally Distributed
3.	Pre-test of experimental group C	0.007	Not Normally Distributed
	Post-test of experimental group C	0.029	Not Normally Distributed

The results of the normality test indicate that the sig. The values of the pre-test and post-test data of experimental group A are 0.052 > 0.05 and 0.088 > 0.05, suggesting that the data is normally distributed. Conversely, the sig. The value of the pre-test and post-test data of experimental group B is 0.001 < 0.05 and 0.019 < 0.05, indicating that the data of experimental group B is not normally distributed. The same conclusion can be drawn for experimental group C, with sig. Values of 0.007 < 0.05 and 0.029 < 0.05 for the pre-test and post-test data, respectively.

Following the initial analysis of data using the normality test, it was determined that the subsequent analysis would utilize the homogeneity test to ascertain whether the pre- and post-test data distribution of experimental group A was homogeneous. It was considered that experimental group A was normally distributed, whereas experimental groups B and C were not. The results of the calculation, facilitated by SPSS version 26.0, indicate that the significant value of experimental group A is 0.00 <0.005, signifying that the data originates from an inhomogeneous population. The outcomes of the normality and homogeneity test analysis serve as a basis for the subsequent analysis, namely the effect test. In instances where data exhibits normal distribution yet heterogeneity, parametric statistical assessments are employed; conversely, non-normal distributed data undergoes examination via non-parametric statistical tests (Novri et al., 2018). The present analysis employs the paired t-test to assess experimental group A data, while experimental groups B and C utilize the Wilcoxon test. The results of the influence test for the three experimental groups are delineated in Table 2.

Table 2. Experimental class effect test results

No.	Groups	Test Types	Sig.	Description
1.	Experimental A	*Paired t-test*	0.00	There is an effect
2.	Experimental B	Wilcoxon Test	0.00	There is an effect
3.	Experimental C	Wilcoxon Test	0.855	There is no effect

The decision criteria and conclusions of the paired t-test and Wilcoxon test are established at a significant level of 5% (0.05). If the significant value is greater than 0.05, it can be deduced that there is no difference in the level of science literacy and numeracy of students before and after media utilization. Conversely, if the significant value is < 0.05, then there is a difference in the level of science literacy and numeracy of students before and after media utilization. As illustrated in Table 2, the paired t-test results of experimental group A and the Wilcoxon test of experimental group B show a significance value of 0.000 < 0.05, indicating that there is a difference in the level of science literacy and numeracy of experimental groups A and B students before and after the implementation of Nearpod physics-based learning media. Conversely, the Wilcoxon test of experimental group C exhibited a significant value of 0.855 > 0.05, indicating that there was no discernible difference in science literacy and numeracy levels of experimental group C students before and after the implementation of the Nearpod

physics-based learning media, in its printed form and augmented by the utilization of QR codes.

The final test administered in this study was the N-gain test, which was designed to ascertain the impact of the intervention on the science literacy and numeracy of the students. While experimental groups A and B exhibited variations in the level of science literacy and numeracy of students before and after the utilization of Nearpod physics-based learning media, the N-gain test was administered in experimental group C. The decision to administer the N-gain test in experimental group C was made to ensure the precise impact of Nearpod print media on each indicator assessed. The outcomes of the N-gain test analysis on the competency aspects of science literacy and numeracy literacy levels and cognitive processes are illustrated in Figure 1.

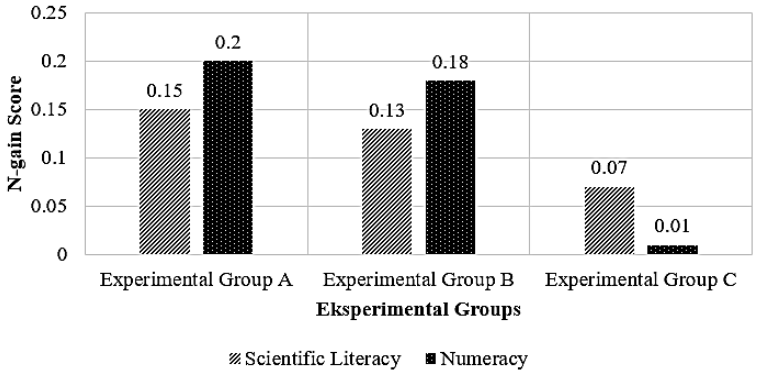

Figure 1. Comparison of N-gain values of the three experimental groups

As illustrated in Figure 1, the N-gain values of the three experimental classes in terms of science literacy and numeracy are classified in the 'low' category, with N-gain values less than 0.3. Subsequent N-gain analysis was undertaken to ascertain the specific N-gain value for each indicator in both science literacy and numeracy. The findings of the comparative analysis of the N-gain scores of the three experimental groups on each indicator in the science literacy competency aspect are presented in Figure 2.

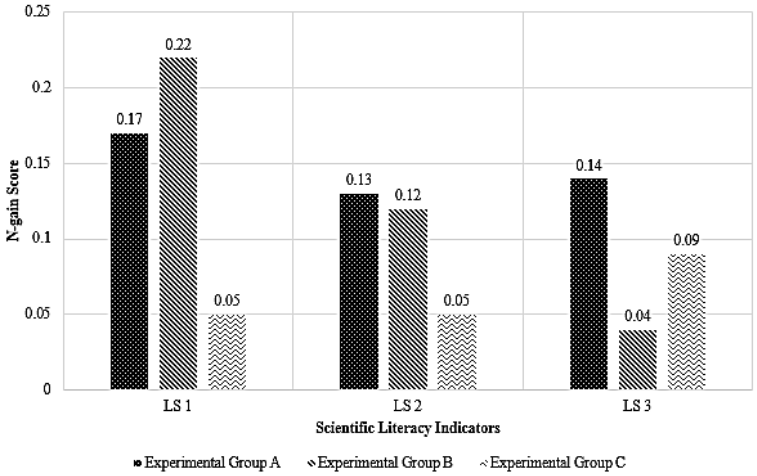

Figure 2. Comparison of n-gain values between experimental groups on each indicator of science literacy competency aspects

All n-gain values of the three experimental groups for each scientific literacy indicator were in the "low" category. Based on Figure 2, experimental groups A and B had the highest gains of 0.17 and 0.22, respectively, in the scientific explanation of phenomena (LS 1) indicator. The enhancement of Indicator 1 skills can be attributed to the integration of interactive videos in the media training phase, which facilitates the understanding of the phenomenon of energy change. The integration of interactive quizzes and simulations further reinforces students' capacity to articulate phenomena from a scientific standpoint. However, this enhancement is not observed in the printed Nearpod, as most interactive features are substituted with conventional, paper-based alternatives, thereby resulting in marginal improvement. Experimental group C demonstrated a marginal improvement of 0.09 on the interpreting data and evidence scientifically (LS 3) when compared to other indicators. This may be attributed to the absence of a significant disparity in the training of LS3 indicators (simulating energy changes) across both directly accessible and printed media.

Compared to the group with Nearpod during learning (blended learning), the class with media before learning showed a significant increase in the indicator of explaining phenomena scientifically. This finding is consistent with the conclusions of Fitriyanasari et al. (2022) who explained that flipped learning significantly increases students' engagement in the learning process and has a positive impact on their academic achievement. The enhancement of student learning outcomes is substantiated by the attainment of elevated N-gain scores in the experimental groups, in comparison to other groups. The disparity in the n-gain values of the experimental groups A and B in indicator 2 is marginal, with a value of 0.01. This slight discrepancy can be attributed to the varying cognitive abilities and learning styles exhibited by each student (Gamiao, 2021). The utilization of PhET Simulations in learning should, in principle, be able to improve students' science (Taibu et al., 2021). However, the inactivity of experimental group B students in group discussions compared to experimental class A was a contributing factor to the low n-gain score of experimental group B on LS 3. Previous studies have revealed that participation in discussion forums can improve various aspects of student learning, such as critical thinking skills and critical reflection in science literacy (Gasmi, 2022).

The findings of this study indicate that students' proficiency in the three science literacy indicators exhibited a tendency to increase in direct proportion to the utilization of Nearpod media in its original form as opposed to its printed form accompanied by a QR code, particularly concerning the indicator of explaining scientific phenomena. This observation is consistent with the conclusions of previous studies which assert the efficacy of Nearpod in enhancing students' science literacy (Ulinnuha, 2023; Davey et al., 2020; Saragi et al., 2025).

The results of the comparative analysis of the N-gain test of the three experimental groups for each indicator in the aspect of level or cognitive process of numeracy literacy are presented in Figure 4.8.

Based on Figure 3, the n-gain value of the three experimental groups on the indicator formulating problems mathematically (LN 1) is in the 'low' category. The experimental group that employed Nearpod directly demonstrated a higher level of improvement in comparison to the group that utilized the printed version of Nearpod. There was minimal discrepancy in the ability training on LN 1 indicators, as both groups of students who employed the direct and printed versions of the Nearpod engaged with

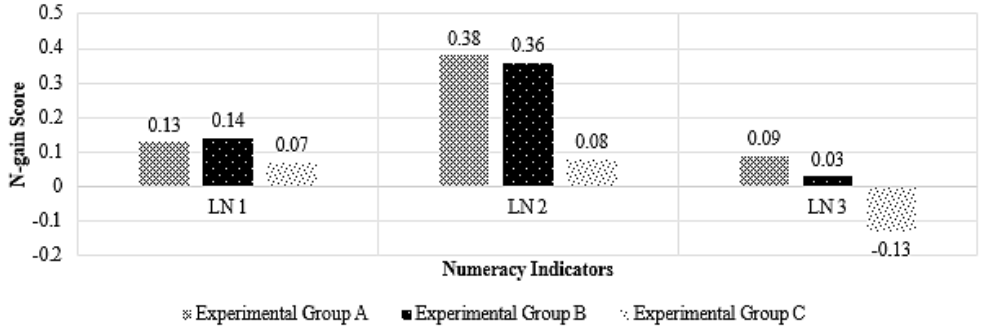

Figure 3. Comparison of n-gain scores between experimental groups on each numeracy literacy indicator

practice questions on student notes. The distinguishing factor pertains to the disparity in students' comprehension of the concept (Gamiao, 2021).

In contrast, the indicator of the use of concepts, facts, procedures, and reasoning in mathematics (LN 2) placed experimental class C in the 'low' category, while groups A and B were in the 'medium' category. The training of these abilities in the media is presented in the form of interactive quizzes, such as puzzles about potential and kinetic energy equations. Furthermore, the incorporation of game-based and practice questions has been shown to enhance students' proficiency in LN 2. However, the limited integration of interactive features into conventional learning methods has been observed to result in a decline in students' N-gain scores. This observation aligns with the findings reported by Aulia et al. (2024),who have asserted that interactive learning media has a favorable impact on enhancing students' learning abilities and performance in comprehending subject concepts.

The significant variation between the three experimental groups was evident in the enhancement of interpretation, application, and evaluation of the mathematical process (LN 3), with experimental groups A and B demonstrating an enhancement in proficiency, while experimental group C exhibited a regression. The augmentation of interactive features that transitioned to conventional methods emerged as the key factor contributing to the regression observed in experimental group C, a finding that is further substantiated by the diminished enthusiasm exhibited by students when engaging with mathematical concepts. This research aligns with Brown's (2019) findings, which indicate that an increased interest among learners in learning involving mathematical concepts serves as evidence that learning approaches involving technology have a positive effect on enhancing the interest and motivation levels experienced during the learning process. Research by of Hanifa & Astuti (2022) also posits that the integration of interactive multimedia in educational settings has been shown to engender a heightened level of enthusiasm among students, thereby facilitating a more profound comprehension of the subject matter. Furthermore, this pedagogical approach ensures that students are actively engaged in every learning activity. Concurrently, research undertaken by Gunawan et al. (2018) posits that student motivation exerts a significant influence on their level of enthusiasm for learning. This assertion is predicated on the premise that heightened levels of student motivation are concomitant with superior learning outcomes.

A non-significant discrepancy was detected between the two groups that used Nearpod in blended learning and flipped learning, as indicated by indicators LN 1 and

LN 2. While experimental group B demonstrated a slight superiority over experimental group A, with a value of 0.01, experimental group A exhibited a greater range of improvement, with a value of 0.02, over experimental group B. According to the findings by Fitriyanasari et al. (2022), the group that employs the flipped learning method should demonstrate a substantially greater degree of improvement in comparison to the group that utilizes blended learning. The efficacy of flipped learning is contingent on students' self-motivation and the extent to which they participate in out-of-class activities (Aidoo et al., 2022).

The data presented in this study indicated that students' proficiency in three numeracy literacy indicators when utilizing Nearpod was higher than the group that employed Nearpod in printed form, particularly in the indicators of using concepts, facts, procedures, and reasoning in mathematics. These results are consistent with those of Wilson's (2020) research, which demonstrated the efficacy of Nearpod in enhancing students' numeracy literacy.

The efficacy of Nearpod in enhancing students' science literacy and numeracy has been examined in this study. The findings indicate that the direct integration of Nearpod into learning experiences demonstrates superior effectiveness in this regard when compared to its use in conjunction with QR codes in print-based learning. Additionally, the application of Nearpod in blended learning scenarios has been observed to yield superior outcomes in terms of enhancing science literacy and numeracy when compared to its use in flipped learning settings. However, it is noteworthy that the overall enhancement of science literacy and numeracy in physics remains in the "low" category. The relatively brief media implementation time (6 x lesson hours) contributes to the low N-gain value, and the media remains novel for students, necessitating adaptation to its integration into learning. Prolonged and continuous use of Nearpod in learning is expected to yield optimal N-gain values.

▪ CONCLUSION

Nearpod is effective in improving science literacy and numeracy in renewable energy, especially in explaining phenomena scientifically in science literacy and using concepts, facts, procedures, and reasoning in mathematics in numeracy. Nearpod in blended learning is more effective than flipped learning and print, with N-gain values for science literacy and numeracy of 0.18 and 0.2 respectively in the 'low' category. This research contributes to the development of media in education by providing practical insights for teachers, as well as motivating and enriching students' learning experiences. Suggestions for future research include experimental methods using control groups to increase the validity of the results.

▪ REFERENCES

Agustia, M., Aprilia, C., Sari, J., Hikmah, D., & Risnita, R. (2020). Using quizizz in learning assesment with science literacy oriented in science learning. International Journal of Engineering, Science and Information Technology, 1(1), 86–90. https://doi.org/10.52088/ijesty.v1i1.213

Aidoo, B., Tsyawo, J., Quansah, F., & Kwadwo Boateng, S. (2022). Students' learning experiences in a flipped classroom: a case study in Ghana. International Journal of

Education and Development Using Information and Communication Technology (IJEDICT), 18(1), 67–85.

Alawadhi, A., & Thabet, R. A. (2022). Using nearpod to promote engagement in online esl classes: a mixed-methods study in the context of higher education. BUiD Doctoral Research Conference 2022 Multidisciplinary Studies, 117–130.

Al-fatlawi, B. M., & Al-Musawi, A. M. T. (2022). The Effectiveness of the (NEARPOD) Program in Generative Thinking among Female Students of the Fifth Grade of Science in Physics. Nasaq, 5(100), 88–98.

Aulia, H., Hafeez, M., Mashwani, H. U., Careemdeen, D. J., Mirzapour, M., & Syaharuddin. (2024). The role of interactive learning media in enhancing student engagement and academic achievement. International Seminar on Student Research in Education, Science, and Technology, 1, 57–67. https://www.researchgate.net/publication/380103660

Brown, C. (2019). The Impact of Nearpod Application on Numeracy Achievement. Journal of Mathematics Education, 45(3), 345-359.

Davey, B. T., Bowers, S., & Spears, S. (2020). NASA eClipsTM interactive lessons: a three-year study of the impact of nasa educational products on student science literacy. Journal of Computers in Mathematics and Science Teaching, 39(4), 383–398.

Della, K. (2024). *Pengembangan video interaktif materi rangkaian arus searah menggunakan canva dan nearpod untuk melatihkan kemampuan berpikir kritis.* Fakultas Keguruan Dan Ilmu Pendidikan, Universitas Lampung.

Fanika, F., Sabarrini, M. A., Rusdiana, D., & Suwarma, I. R. (2022). *Pengembangan media untuk kegiatan pembelajaran berbasis e-media nearpod pada materi hukum hooke*. Jurnal Ikatan Alumni Fisika Universitas Negeri Medan, 8(1), 38–43.

Fitriyanasari, L., Wardono, & Isnarto. (2022). Numerical literacy of fifth grade elementary school students in terms of learning styles through google classroom assisted discovery learning models. International Journal of Education and Research, 10(12). www.ijern.com

Gamiao, C. U. (2021). Cognitive ability, learning styles and academic performance of the freshmen students. International Journal of Arts and Social Science, 4(3), 219–229. www.ijassjournal.com

Gasmi, A. A. (2022). Through the lens of students: how online discussion forums affect students' learning. International Journal of Technology in Education, 5(4), 669–684. https://doi.org/10.46328/ijte.291

Giday, D. G., & Perumal, E. (2024). Students' perception of attending online learning sessions post-pandemic. Social Sciences and Humanities Open 9, 9, 100755–100755. https://doi.org/10.1016/j.ssaho.2023.100755

Green, T. D., Besser, E. D., & Donovan, L. C. (2021). More than amplifying voice and providing choice: educator perceptions of flipgrid use in the classroom. TechTrends, 65(5), 785–795. https://doi.org/10.1007/s11528-021-00635-3

Gunawan, G., Kustiani, L., & Hariani, L. S. (2018). *Faktor-faktor yang mempengaruhi hasil belajar siswa.* Jurnal Penelitian Dan Pendidikan IPS (JPPI), 12(1), 14–22.

Hanifa, I., & Astuti, F. (2022). *Perbedaan hasil belajar seni tari menggunakan multimedia interaktif dengan media konvensional pada siswa di smp n 1 talamau.* Jurnal Sendratasik, 11(3), 391–401. https://doi.org/10.24036/js.v11i3.117813

Hasiru, D., Badu, S. Q., & Uno, H. B. (2021). *Media-media pembelajaran efektif dalam membantu pembelajaran matematika jarak jauh.* Jambura Journal of Mathematics Education, 2(2), 59–69. https://doi.org/10.34312/jmathedu.v2i2.10587

Idawati, Maisarah, Muhammad, Meliza, Arita, A., Amiruddin, & Salfiyadi, T. (2022). *Pemanfaatan canva sebagai media pembelajaran sains jenjang SD.* Jurnal Pendidikan Dan Konseling, 4(4), 745–751. https://core.ac.uk/download/pdf/322599509.pdf

Khoirunnisa, S., & Adirakasiwi, A. G. (2023). *Analisis kemampuan literasi numerasi siswa smp pada era merdeka belajar.* Jurnal Pembelajaran Matematika Inovatif, 6(3), 925–936. https://doi.org/10.22460/jpmi.v6i3.17393

Kurniawati, E. (2024). *Penerapan strategi conceptual change text (cct) melalui media interaktif nearpod untuk mendeteksi dan mereduksi miskonsepsi pada materi cahaya. S1 thesis*, Universitas Jambi.

Loveless, B. (2023). 15 Learning Theories in Education.

Martín-Sómer, M., Casado, C., & Gómez-Pozuelo, G. (2024). Utilising interactive applications as educational tools in higher education: perspectives from teachers and students, and an analysis of academic outcomes. Education for Chemical Engineers, 46, 1–9. https://doi.org/10.1016/j.ece.2023.10.001

Melinda, V., Hariyono, E., Erman, E., & Prahani, B. K. (2021). Profile of students' scientific literacy in physics learning during covid-19 pandemic. Journal of Physics: Conference Series, 2110(1). https://doi.org/10.1088/1742-6596/2110/1/012031

Mujahidin, A. A., Salsabila, H., Hasanah, A. L., Andani, M., & Aprillia, W. (2021). *Pemanfaatan media pembelajaran daring (quizizz, sway, dan wordwall) kelas 5 di SD Muhammadiyah 2 Wonopeti.* INNOVATIVE: Journal of Social Science Research , 1(2), 552–560.

Mustakim, M. (2020). *Efektivitas pembelajaran daring menggunakan media online selama pandemi covid-19 pada mata pelajaran matematika.* Al Asma: Journal of Islamic Education, 2(1), 1–12.

Natale, C. C., Mello, P. S., Trivelato, S. L. F., Marzin-Janvier, P., & Manzoni-De-Almeida, D. (2021). Evidence of scientific literacy through hybrid and online biology inquiry-based learning activities. Higher Learning Research Communications, 11, 33–49. https://doi.org/10.18870/HLRC.V11I0.1199

Novri, U. S., Zulfah, Z., & Astuti, A. (2018). *Pengaruh strategi react (relating, experiencing, applying, cooperating, transfering) terhadap kemampuan pemahaman konsep matematis peserta didik kelas vii smp negeri 1 bangkinang.* Jurnal Cendekia: Jurnal Pendidikan Matematika, 2(2), 81–90.

Nurhayati, D., Az-zahra, H. M., & Herlambang, A. D. (2019). Evaluasi user experience pada edmodo dan google classroom menggunakan technique for user experience evaluation in e-learning (TUXEL) (Studi Pada SMKN 5 Malang). Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer, 3(4), 3771–3780. http://j-ptiik.ub.ac.id

OECD. (2017). PISA 2015 Assessment and analytical framework: science, reading, mathematic, financial literacy and collaborative problem solving. OECD. https://doi.org/10.1787/9789264281820-en

Oktariya, P., Herlina, K., & Abdurrahman, A. (2023). Development of problem-based e-lkpds assisted by canva to stimulate numeracy skill and visual literacy. Jurnal

Penelitian Pendidikan IPA, 9(12), 12303–12308. https://doi.org/10.29303/jppipa.v9i12.4683

Østergaard, P. A., Duic, N., Noorollahi, Y., & Kalogirou, S. (2022). Renewable energy for sustainable development. Renewable Energy, 199, 1145-1152.

Palumbo, R. (2022). Thriving in the post-covid-19 era: a new normality for libraries' service offering. Library Management, 43(8–9), 536–562. https://doi.org/10.1108/LM-05-2022-0051

Priante, A., & Tsekouras, D. (2025). Integrating technology in physical classrooms: the impact of game-based response systems on student learning experience. Information and Management, 62(3). https://doi.org/10.1016/j.im.2025.104105

Putri, Kinanti Eka (2024). *Penerapan strategi conceptual change text (cct) melalui media interaktif nearpod untuk mereduksi miskonsepsi peserta didik pada materi tekanan hidrostatis dan hukum archimedes.* S1 Thesis, Universitas Jambi.

Qiao, Y. (2022). K-12 Science learning: designing a lesson on nearpod to teach projectile motion. Proceedings of the 2022 8th International Conference on Humanities and Social Science Research (ICHSSR 2022), 664(Ichssr), 2122–2127. https://doi.org/10.2991/assehr.k.220504.384

Rahmani, M. N. (2022). *Pengaruh Pendekatan Integrated STEM Berbantuan Nearpod terhadap.* Universitas Islam Negeri Syarif Hidayatullah.

Ramadhan, S., Sukma, E., & Indriyani, V. (2021). Online distance learning while the covid-19 pandemic: implementation, evaluation, and expectations. Proceedings of the 4th International Conference on Language, Literature, and Education (ICLLE-4 2021), 604(21), 267–275. https://doi.org/10.2991/assehr.k.211201.040

Rosa, L. P., Susilo, H., & Zubaidah, S. (2023). The effect of guided inquiry based google classroom on scientific literacy and critical thinking of students biology. In AIP Conference Proceedings (Vol. 2569, No. 1). AIP Publishing.

Rosidah, Nizaar, M., Muhardini, S., Haifaturrahmah, & Mariyati, Y. (2022). *Efektifitas media pembelajaran game interaktif berbasis power point untuk meningkatkan motivasi belajar siswa kelas V SD.* Seminar Nasional Paedagoria, 2(1), 10–16. http://journal.ummat.ac.id/index.php/fkip/article/view/9749%0Ahttp://journal.ummat.ac.id/index.php/fkip/article/download/9749/pdf

Saefurohman, S., Maryanti, R., Azizah, N. N., Fitria, D., Husaeni, A., Wulandary, V., & Irawan, A. R. (2023). Efforts to increasing numeracy literacy of elementary school students through quiziz learning media. ASEAN Journal of Science and Engineering Education, 3(1), 11–18. https://doi.org/10.17509/xxxx.xxxx

Saragi, F., Aisyah, N. R., Suprianto, B., & Hamdiyati, Y. (2025). *Pembelajaran guided inquiry dikombinasikan dengan nearpod untuk meningkatkan literasi sains siswa pada materi perubahan lingkungan.* SCIENCE : Jurnal Inovasi Pendidikan Matematika Dan IPA, 4(4).

Sembiring, B. O., & Napitupulu, E. E. (2022). Development of interactive student's worksheets to improve mathematical hots of tenth grade students in trigonometry topic. AlphaMath Journal of Mathematics Education, 8(2), 99–110.

Sudiar, S., Djudin, T., Hidayatullah, M. M. S., Silitonga, H. T. M., & Oktavianty, E. (2023). *Penerapan model direct instruction berbantuan media audiovisual nearpod pada materi gravitasi newton.* Jurnal Ilmiah Profesi Pendidikan, 8(4), 2394–2402. https://doi.org/10.29303/jipp.v8i4.1617

Syarifuddin, S., Aksan, H., Santri, D. J., Izzah, I., Fathurohman, A., Oktapiani, R., & Lestari, D. (2024). Training and mentoring to strengthen literacy and numeracy in the learning recovery of the ogan ilir region. Unram Journal of Community Service, 5(4), 473–477. https://doi.org/10.29303/ujcs.v5i4.755

Taibu, R., Mataka, L., & Shekoyan, V. (2021). Using PhET simulations to improve scientific skills and attitudes of community college students. International Journal of Education in Mathematics, Science and Technology, 9(3), 353–370. https://doi.org/10.46328/IJEMST.1214

Tiwari, P., Séraphin, H., & Chowdhary, N. R. (2021). Impacts of COVID-19 on tourism education: analysis and perspectives. Journal of Teaching in Travel and Tourism, 21(4), 313–338. https://doi.org/10.1080/15313220.2020.1850392

Ulinnuha, D. (2023). *Pengembangan media pembelajaran interaktif nearpod tema etnosains (jamu tradisional) dalam peningkatan literasi sains pada mata pelajaran IPA SMP/MTs.* Undergraduate thesis, IAIN KUDUS.

Wilson, L. (2020). Exploring the use of nearpod to increase student engagement and achievement in mathematics. Journal of Research in Innovative Teaching & Learning, 13(2), 205-225.

Wumu, A., Mursalin, & Buhungo, T. J. (2023). Effectiveness of problem-based learning model assisted by canva-oriented pancasila student profiles to improve scientific literacy. Jurnal Penelitian Pendidikan IPA, 9(8), 5892–5898. https://doi.org/10.29303/jppipa.v9i8.4022

Yuan, Y., Zhang, Z., & Zhao, Y. (2022). Technology and education: a study of the impact of educational video games on physics teaching. Proceedings of the 2021 International Conference on Education, Language and Art (ICELA 2021), 637(Icela 2021), 382–387. https://doi.org/10.2991/assehr.k.220131.070