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Improving student learning outcomes through the inquiry learning model with powtoon animation on plane geometry subject

Asri Dwi Safitri [a,1], Rusnilawati Rusnilawati [a,2,*]

[a] Pendidikan Guru Sekolah Dasar, Fakultas Keguruan dan Ilmu Pedidikan, Universitas Muhammadiyah Surakarta, Indonesia
[1] a510200261@student.ums.ac.id; [2] rus874@ums.ac.id*
* corresponding author

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ABSTRACT

The objective of the study is to illustrate how the enactment of the inquiry learning model with Powtoon animation impacts the enhancement of student learning outcomes in the plane geometry subject. This study utilizes a quantitative method employing a quasi-experimental design. The sampling method applied is cluster random sampling, involving two groups for the study: the experimental group and the control group, serving as the comparative sample. The sample for the study comprises 52 fifth-grade students, with each class containing 26 students. Data collection instruments include test sheets, observation sheets, and documentation. Data analysis techniques in statistical tests include instrument validity testing, instrument reliability testing, prerequisite testing, dependent t-test, independent t-test, and N-Gain test. Learning outcomes after implementing the inquiry learning model with Powtoon animation media were significantly different compared to before implementation. Moreover, there was a notable distinction in learning outcomes observed between the control and experimental groups. The average posttest score for the experimental group stood at 74,04, whereas for the control group, it was 61,69. The influence of the inquiry learning model with Powtoon animation media reached a moderate category. Involving technology such as Powtoon animation in inquiry-based learning can generate interest in learning, thus affecting the improvement of student learning outcomes.

1. Introduction

One field of study that plays a major role in education is Mathematics. Mathematics holds a fundamental position within the Indonesian curriculum across all educational levels, particularly at the Elementary School level [1]. This is intended to equip students with the ability to acquire, understand, and utilize all information acquired to survive and thrive in line with the development of the times. In mathematics learning, a good teaching and learning process needs to be designed to ensure that students find enjoyment and remain engaged throughout the learning process. This is because each student has a different perspective on mathematics [2]. Some students consider mathematics to be an enjoyable subject, while others find it to be a complex subject [3]. Students who derive pleasure from mathematics will feel incentivized to engage with the subject and approach challenging mathematical problems with optimism. Conversely, students who find mathematics to be complex will feel pessimistic about solving mathematical problems, resulting in lower learning outcomes. Based on the student learning outcomes data obtained from the fifth-grade teachers at SD Muhammadiyah Karangasem, it's apparent that many students have not reached the Minimum Mastery Criteria. This can be seen in the mid-semester exam results for the academic year 2023/2024, which show that out of 28 students, only 46.43% of students achieved the Minimum Mastery Criteria, while 53.57% are still below the Minimum Mastery Criteria. Therefore, it can be inferred that the learning outcomes of the students remain inadequate. The teaching models utilized by the teachers are contributing factors to the subpar learning outcomes. Based on interviews, teachers more often apply conventional teaching models such as lectures, discussions, question and answer sessions, and peer tutoring, which make students feel bored and consequently affect their learning outcomes negatively. Hence, there is a necessity to prioritize enhancing student learning outcomes.

Student learning outcomes refer to the mastery extent achieved by students, or what they have learned in school according to the learning objectives [4]. The effectiveness of teaching significantly impacts student learning outcomes [5]. Therefore, to achieve high student learning outcomes, teachers must use the appropriate teaching models in the classroom to make learning effective [6]. Teachers' ability to adapt teaching models to the material being taught in the classroom is crucial [7]. By providing better teaching models, students become more independent in their learning, thus achieving better learning outcomes [8]. One teaching model that can support learning outcomes is inquiry-based learning [9]. Inquiry-based learning is an informative approach that extensively engages students in systematic, critical, logical, and analytical exploration, empowering them to formulate their own conclusions based on their perspectives [10]. Inquiry-based learning emphasizes activities of searching and discovery, meaning that the inquiry-based learning model places students as the subjects of the learning activities. All activities carried out by students are aimed at seeking and discovering something that is questioned, thus it is expected to foster self-confidence, meaning that teachers are placed not as a source of learning but as facilitators and motivators of student learning [11]-[12]. The use of the inquiry-based learning model has a positive and significant impact on improving learning outcomes. To attain this objective, it's essential to utilize captivating and entertaining educational tools, among which is Powtoon animation software. Powtoon media is an instructional tool in the form of animation video software displayed to students through animated images and sound [13]. Powtoon serves as a viable alternative for educational media in schools, aiming to capture attention, boost motivation and learning outcomes, and diversify the learning process [14]-[15]. Research by [16], suggests that employing Powtoon instructional media influences student learning outcomes. The literature reveals the inquiry model altered student learning outcomes and motivation. Additionally, several studies have also found the impact of Powtoon media on learning. However, there are still few studies that combine the inquiry learning model with Powtoon animation media. Hence, the objective of this research is to explore the efficacy of integrating the inquiry learning pattern with Powtoon animation media in enhancing student learning outcomes in the plane geometry subject.

2. Method

The research methodology adopted is quantitative in nature, specifically experimental research. Experimental research is utilized to analyze the impact of particular treatments on others within controlled conditions [17]. This study utilizes a quasi-experimental design employing a nonequivalent control group design. The quasi-experimental design incorporates a control group; however, it can not completely authorize outer variables that may influence the observation's execution [18]. In the quasi-experimental design featuring a nonequivalent control group, both the experimental and control groups undergo pretests to establish the initial conditions. Afterward, both groups are given different treatments, followed by a posttest at the end of the research. The study's population includes all fifth-grade students at SD Muhammadiyah Karangasem, encompassing three classes: 5.1, 5.2, and 5.3, totaling 80 students. The sampling method for this study is conducted using cluster random sampling, a sampling technique used to determine samples when the objects to be studied or the data sources are very extensive. All classes in the population have an equal opportunity to be sampled using this technique. To determine the sample, the researcher randomly selected classes using a spinning application, resulting in class 5.3 as the experimental group and class 5.2 as the control group. The sample utilized in this study comprises 52 students distributed across these two classes. Data collection methods encompass tests, observations, and documentation. The test employs pretest and posttest instruments comprising multiple-choice questions. The difficulty level of the test questions is depicted in the subsequent Table 1. The indicators for HOTS questions are that students demonstrate problem-solving abilities in calculating the length of the sides of plane geometry squares and interpret images corresponding to statements about plane geometry. Additionally, students are able to check statements that match the problem.

Table 1. Test Question Levels

Question Level	Cognitive Level	Number of Questions
LOTS	C1 – C3	9
HOTS	C4 – C5	11

Moreover, the indicators for HOTS questions are that students can conclude the area that matches the problems in daily life. As for the indicators for LOTS questions, students are able to determine the lengths of squares, rectangles, and triangles. Furthermore, students are also able to determine the base and height of plane geometry triangles. Validity testing is used to assess the instrument's validity to be used in the study. The validity testing in this research utilizes SPSS software version 26. In the validity testing, r_{table} value at a significance level of 5% with N = 27 is 0.381; Therefore, a question item is considered valid if $r_{count} > r_{table}$, and if $r_{count} < r_{table}$, it is considered invalid. As regards the validity testing of the test instrument, out of 20 pretest question items, 10 items are declared valid, and out of 20 posttest question items, 15 items are declared valid. Meanwhile, reliability testing of the instrument is used to determine the reliability of an instrument to be used in the study. In reliability testing, r_{table} value at a significance level of 5% with N = 27 is 0.381; Therefore, an item is considered reliable if $r_{count} > r_{table}$, and if $r_{count} < r_{table}$ the item is considered unreliable. Based on the reliability testing of the instrument, it is known that both the pretest and posttest question items are reliable. The results of the test instrument reliability assessment are described in Table 2.

Table 2. Reliability Test Result

Instrument	r_{count}	r_{table}	Description
Pretest	0.659	0.381	Reliable
Posttest	0.852	0.381	Reliable

Data analysis was carried out utilizing SPSS version 26 for Windows and Excel software. Inferential statistical analysis, including preconditions testing and hypothesis testing, along with the N-Gain Test, was conducted on the test data. Precondition tests comprised normality and homogeneity tests. The normality test assessed the distribution of final test data for normality, while the homogeneity test evaluated the homogeneity of learning outcomes data. Hypothesis testing involved independent and dependent t-tests. Subsequently, the N-Gain test assessed the effectiveness of the treatment administered. The hypotheses of the research are outlined below.

2.1. Independent t-test

- Independent t-test Pretest: Ho, the student learning outcomes in mathematics before using the inquiry learning model with powtoon animation media are not better than before using the contextual model aided by power point ($\mu_2 \leq \mu_1$). Ha, the student learning outcomes in mathematics before using the inquiry learning model with powtoon animation media are better than before using the contextual model aided by power point ($\mu_2 > \mu_1$).
- Independent t-test Posttest: Ho, the student learning outcomes in mathematics after using the inquiry learning model with powtoon animation media are not better than after using the contextual model aided by power point ($\mu_2 \leq \mu_1$). Ha, the student learning outcomes in mathematics after using the inquiry learning model with powtoon animation media are better than after using the contextual model aided by power point ($\mu_2 > \mu_1$).

2.2. Dependent t-test

- Ho: The student learning outcomes in mathematics after using the inquiry learning model with powtoon animation media are not better than before ($\mu_2 \leq \mu_1$).
- Ha: The student learning outcomes in mathematics after using the inquiry learning model with powtoon animation media are better than before ($\mu_2 > \mu_1$).

2.3. Formula for N-Gain is as follows [19].

The N-Gain test was conducted to determine the increase in students' cognitive learning outcomes after treatment. This increment is deducted from the students' pretest and posttest results. The difference between the actual and ideal gain scores is called N-gain. The pupils' actual gain score is the score they actually received, but the ideal gain score is the maximum score they may possibly receive.

$$N\ Gain = \frac{Skor\ Postest - Skor\ Pretest}{Skor\ Ideal - Skor\ Pretest} \quad (1)$$

For the categorization of N-Gain values, refer to the following Table 3 [20].

Table 3. N-Gain Score Categories

N-Gain Score	Category
g > 0.7	High
0.3 ≤ g ≤ 0.7	Moderate
g > 0.3	Low

3. Results and Discussion

3.1. Results

Implementation of this study includes three stages of activities: Pretest, Treatment, and Posttest. Pretests were given to students in the experimental and control classes with the purpose of evaluating the initial capabilities of students in both groups. Following the administration of the pretests, distinct treatments were applied to the experimental and control classes. The experimental class underwent a learning process utilizing the inquiry learning model integrated with Powtoon animation media. The learning sessions in the experimental class occurred three times on January 30th, 31st, and February 1st, 2024. The learning sessions began with an introduction, core activities, and a conclusion. The primary activities commenced with six steps: (1) problem identification; (2) problem formulation; (3) hypothesis development; (4) data gathering; (5) hypothesis testing; and (6) conclusion drawing. At the problem orientation stage, students are divided into 7 groups then each group will get a worksheet. Then students recognize the problem through discussion with their group. The second stage is formulating the problem, students in groups formulate the problem and write the results of the problem formulation on the worksheet provided by the teacher.

Furthermore, in the stage of formulating hypotheses, students and teachers discuss problems and problem formulations that will give rise to hypotheses. Then students with their groups collect data based on data that is in accordance with the hypothesis that has been formulated together. In the next stage, students listen to the Powtoon animation video. Powtoon animation videos are shown in order to make it easier for students to test hypotheses. After listening to the Powtoon animation video, students with their groups test the hypothesis and compile data. After that, students draw conclusions followed by presentations in front of the class in turn and give each other responses. Then students and teachers draw conclusions together. Fig. 1 shows the learning activities at the beginning. In this stage, the teacher organizes the class by dividing it into 7 groups. Then, students are given worksheets and they listen to the teacher's explanation about the workflow of the worksheet. Next, students are directed to formulate the problem. In this stage, students formulate the problems presented by the teacher on the worksheet. Students are guided by the teacher in formulating the problems.

Fig. 1. Initial Activities

Fig. 2 depicts group activities. In this stage, students formulate hypotheses by discussing them with their respective groups. Next, they collect data. The students' activity in collecting data is guided by the teacher. After collecting data, they write down the results on the worksheet.

Fig. 2. Group Activities

Fig. 3 (a) and Fig. 3 (b) show visual representations of Powtoon animation media. The Powtoon animation media is presented to facilitate students in testing hypotheses. After watching the video, students test the hypotheses provided on the worksheet to determine their validity. The next step is to draw conclusions. When drawing conclusions, students write down their conclusions on the worksheet. Once finished, a representative from each group presents their conclusions before the class. Other groups and the teacher provide feedback. Subsequently, students together with the teacher draw conclusions.

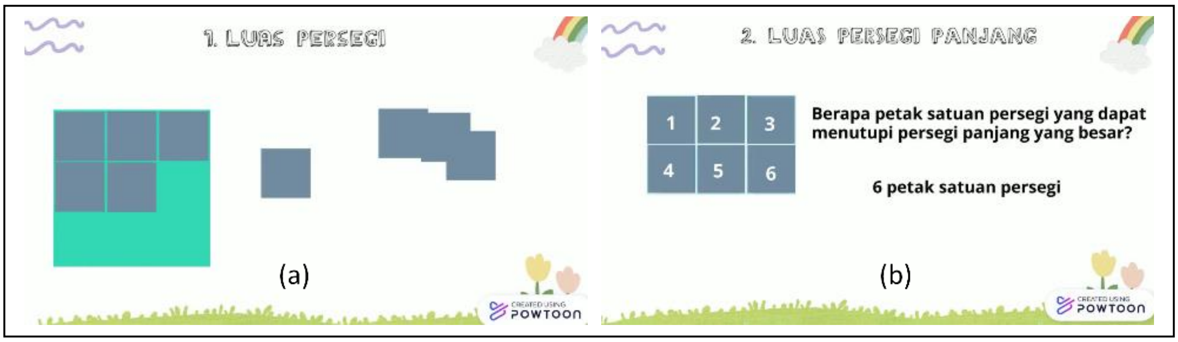

Fig. 3. (a) Powtoon Animation Media; (b) Powtoon Animation Media

In the instructional approach adopted for the control class, the contextual method supplemented by PowerPoint was employed. The learning sessions in the control group occurred twice on January 30-31, 2024. The learning procedure entailed the teacher delivering lectures on the subject matter with the aid of PowerPoint, while students engaged in group activities, addressing questions that were then gathered at the conclusion of the lesson. After both the experimental and control classes received treatment, the posttest was conducted. The experimental class took place on February 2, 2024, while the control class took place on February 1, 2024. The execution of the learning process was observed on two occasions. The data obtained from the observation of the learning process was used to assess the implementation of the steps of learning using the inquiry model with Powtoon animation media as outlined in the teaching module. In the first meeting, the implementation of the learning process was 80%, and in the second meeting, it was 90%. In light of these findings, it can be inferred that the learning in the experimental class proceeded in accordance with the steps of learning using the inquiry model with Powtoon animation media. The outcomes of the normality test conducted using SPSS are displayed in the subsequent Table 4.

Table 4. Normality Test Result

Test Type	Category	Sig. Number	Desciption
Pretest	Experiment	0.101	Data distributed normally
	Control	0.196	Data distributed normally
Posttest	Experiment	0.293	Data distributed normally
	Control	0.263	Data distributed normally

Normality assessment of the data through the Shapiro-Wilk test, as shown in Table 5, reveals significance values of 0.101 and 0.196 for the experimental and control classes' Pretest data, correspondingly. Similarly, for the post-test data, the significance values are 0.293 and 0.263 for the experimental and control classes, respectively. These significance values, exceeding 0.05; suggest that the data conforms to a normal distribution.

Table 5. Homogeneity Test Result

Data 1	Data 2	Sig.	Description
Posttest Experiment Class	Posttest Control Class	0.565	Homogen
Pretest Experiment Class	Posttest Experiment Class	0.088	Homogen

The homogeneity test of the student learning outcomes data in Table 6 shows significance values of 0.565 and 0.088. This suggests that the significance values exceed 0.05; indicating homogeneous variance in student learning outcomes. Consequently, with normally distributed and homogeneous data, an independent t-test is conducted, as illustrated in the subsequent Table 6.

Table 6. Independent t-Test Pretest Data Result

Sig. (2-tailed)	Significance Level *(α)*	Description
0.441	0.05	Ho accepted

According to the outcomes of the independent t-test presented in Table 7, the obtained significance value is 0.441. As 0.441 > 0.05; Ho is accepted, while Ha is rejected. Essentially, Ho is accepted, signifying that there exists no disparity in the average learning outcomes between students who engaged in learning with the inquiry learning model incorporating Powtoon animation media and those who did not participate in such learning. This conclusion is applicable to both the control and experimental classes. Consequently, it may be inferred that the capabilities of students in both the experimental and control classes are comparable.

Table 7. Independent t-Test Posttest Data Result

Sig. (2-tailed)	Significance Level *(α)*	Description
0.001	0.05	Ho rejected

Table 8 displays significance values for each class at 0.001. As 0,001 < 0.05; Ho is rejected, and Ha is accepted. Put differently, Ho is dismissed, suggesting a discrepancy in the average learning outcomes between students who were engaged in learning with the inquiry learning model utilizing Powtoon animation media and those who were not involved in such learning.

Table 8. Dependent t-Test Pretest dan Posttest Data Result

Sig. (2-tailed)	Significance Level *(α)*	Description
0.000	0.05	Ho accepted

In Table 9, the significance value for the experimental class is indicated as 0.000. With 0.000 < 0.05; Ho is rejected, and Ha is accepted. This inferred that the student learning outcomes in mathematics following the implementation of the inquiry learning model with Powtoon animation media are superior to those prior to its implementation.

Table 9. N-Gain Test (Pretest dan Posttest Experiment Data)

Number of Students	Average Pretest Score Experiment	Average Posttest Score Experiment	N-Gain	Category
26	49.62	74.04	0.486	Moderate

Based on Table 10, the Normalized Gain (N-Gain) test indicates a value of 0.486 for the experimental class. This means that the experimental class falls into the moderate category because 0.486 falls within the interval $0.3 \leq g \leq 0.7$. Hence, it can be deduced that employing the inquiry learning model with Powtoon animation media to improve learning outcomes demonstrates a moderate level of influence. Based on Table 10, the Normalized Gain (N-Gain) test indicates a value of 0.302. Therefore, if we follow the N-Gain categorization, it falls into the moderate category because 0.302 falls within the interval $0.3 \leq g \leq 0.7$. Hence, this suggests that the inquiry learning model with Powtoon animation media in improving learning outcomes compared to the contextual model aided by Power Point has a moderate influence.

Table 10. N-Gain Test (Posttest Experiment dan Posttest Control Data) Result

Number of Students	Average Pretest Score Experiment	Average Posttest Score Control	N-Gain	Category
52	74.04	61.69	0.302	Moderate

3.2. Discussions

According to the data analysis findings, it's clear that implementing the inquiry learning model with Powtoon animation media enhances students' learning outcomes in plane geometry. In the pretest, both the control and experimental classes exhibited comparable learning outcomes, indicating that the proportion of student learning outcomes prior to any treatment was identical. Previously, teachers used supplementary textbooks as learning media. Additionally, the teaching models used were not varied enough. As a result, students' learning outcomes were not optimal. The instructional approach employed in the experimental class, incorporating the inquiry learning model with Powtoon animation media for plane geometry, offered greater diversity and minimized monotony. It enhanced enjoyment by facilitating active student involvement through group investigations within the learning process. The use of the inquiry learning model with Powtoon animation media helps students understand the concepts being taught. This study's findings suggest that the interactive implementation of the inquiry learning model with Powtoon animation media between teachers and students positively impacts students' learning outcomes in plane geometry. The improved capacity of students in the experimental class can be credited to their active involvement throughout the learning process, as demonstrated by their completion of all post-test questions. Inquiry is a learning model that extends students the chance to discover concepts through scientific steps [21]. The teacher's task in teaching with the inquiry learning model is to prepare learning scenarios and provide learning media aimed at ensuring smooth learning. Inquiry learning with Powtoon animation media demonstrates student engagement and enhances student learning outcomes.

The learning process in the control class does not utilize the inquiry learning model with Powtoon animation media for plane geometry. In the control class, the instructional approach solely relies on the contextual learning model with PowerPoint media. Students in this class typically exhibit passivity during learning sessions, preferring to remain silent and listen to the material without actively engaging in class interactions [22]-[23], found that several factors contribute to the low learning outcomes of students, one of which is the constraints associated with the learning materials utilized by teachers in teaching mathematical concepts. Meanwhile, according to [24], educational media can effectively deliver instructional content, facilitating students' comprehension and understanding. The utilization of Powtoon animation media in student learning, according to [25] indicates that the learning media motivates, challenges, and stimulates students' skills, thereby positively impacting student learning outcomes. This aligns with a study by [26] that the implementation of Powtoon animation media can improve students' comprehension of the subject matter. Learning outcomes will improve due to students' favorable mindset in participating in learning activities [27]. The utilization of suitable teaching methodologies and educational resources significantly impacts the learning process, affecting students' motivation, class participation, attentiveness to the material, and ultimately, their learning outcomes. Given that plane geometry concepts may not inherently captivate students, implementing the inquiry learning model with Powtoon animation media proves beneficial in enhancing various facets of learning. This approach contributes to an improvement in plane geometry skills. In the control class, researchers present the material and encourage student interaction through peer questions and discussions. While some students grasp the content well, many do not actively participate during the posttest. Conversely, in the experimental class employing the inquiry learning model with Powtoon animation media, students demonstrated higher average post-test scores compared to those in the control class.

4. Conclusion

Learning using the inquiry model with Powtoon animation media on plane geometry material has the potential to improve student learning outcomes. This is because this combination has not been extensively researched in previous studies but has the potential to produce better learning outcomes. Involving technology such as Powtoon animation in inquiry-based learning can generate interest in learning, thus affecting the improvement of student learning outcomes. In light of the research results, it is evident that there exists a notable disparity in students' academic achievements after the implementation of the inquiry learning model with Powtoon animation compared to before its implementation. Additionally, the learning outcomes of students differ significantly between the control and experimental groups. This is apparent from the comparison of the mean post-test scores between the experimental and control groups. Specifically, the experimental group achieved an average post-test score of 74.04, whereas the control group scored an average of 61.69. In this research, the impact of utilizing the inquiry learning model with Powtoon animation media falls within the moderate range. The limitation of this study is that it only focuses on improving learning outcomes in plane geometry. Additionally, the research was conducted only at the elementary school level. Future research is recommended to apply the inquiry model with Powtoon animation media to other learning materials and to identify the differences in using more effective models and media to improve learning outcomes. Learning with the inquiry model and Powtoon animation media allows teachers to create more interactive learning experiences, thus enhancing student learning outcomes. The implication of this research is that the inquiry learning model with Powtoon animation media can be considered as one alternative to be implemented in teaching to help improve student learning outcomes.

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References

[1] U. Hasanah, Maimunah, and Y. Roza, "Analysis of ability to understand mathematic concepts of SMP students during online learning on set materials," *Daya Mat. J. Inov. Pendidik. Mat.*, vol. 9, no. 3, pp. 186–190, 2021, doi: 10.26858/jdm.v9i3.24633.

[2] G. T. Matney, C. Fischer, and J. L. J. Ii, "Understanding students' perceptions of Doing Mathematics: A Cultural Comparison," *Southeast Asian Math. Educ. J.*, vol. 12, no. 2, pp. 105–124, 2022, doi: 10.46517/seamej.v12i2.185.

[3] M. Langoban, "What makes mathematics difficult as a subject for most students in higher education ?," *Int. J. English Educ.*, vol. 9, no. 3, pp. 214–220, 2020.

[4] L. Hikmatullah and U. Khasanah, "Relationship between learning intensity, numerical skills, and extracurricular participation with mathematical learning outcomes of SMA Negeri 1 Pundong," *AdMathEduSt*, vol. 4, no. 5, 2017, doi: 10.12928/admathedust.v4i5.16366.

[5] L. Judijanto, T. Supriyadi, J. H. Lumbantoruan, and Jeranah, "Elementary school students ' effectiveness towards improving mathematics learning outcomes in additional material," *Mimb. Sekol. Dasar*, vol. 10, no. 3, pp. 614–625, 2023, doi: 10.53400/mimbar-sd.v10i3.65455.

[6] R. Shoukat, I. Ismayil, Q. Huang, M. Oubibi, M. Younas, and R. Munir, "A comparative analysis of blended learning and traditional intruction : Effect on academic motivation dan learning outcomes," *PLoS One*, vol. 19, no. 3, 2024, doi: 10.1371/journal.pone.0298220.

[7] E. Guna, E. Sulistri, and N. Marsela, "Picture and picture method media puzzle assisted on learning outcomes in the cognitive realm of Grade V elementary school students," *J. Pendidik. Sekol. Dasar*, vol. 9, no. 2, pp. 39–44, 2022, doi: 10.26555/jpsd.v9i2.a24688.

[8] J. E. R. Marantika, "The relationship between learning styles , gender and learning," *Cypriot J. Educ. Sci.*, vol. 17, no. 1, pp. 56–67, 2022, doi: 10.18844/cjes.v17i1.6681.

[9] E. Apriani, A. Susanta, and I. Koto, "The development of inquiry-based mathematics teaching materials for space figures for elementary schools," *Int. J. Trends Math. Educ. Res.*, vol. 5, no. 4, pp. 387–393, 2022, doi: 10.33122/ijtmer.v5i4.146.

[10] M. Pedaste *et al.*, "Phases of inquiry-based learning: Definitions and the inquiry cycle," *Educ. Res. Rev.*, vol. 14, pp. 47–61, Feb. 2015, doi: 10.1016/j.edurev.2015.02.003.

[11] A. Aziz, Budiyono, and S. Subanti, "The effect of inquiry learning and discovery learning on student learning achievement viewed from spatial intelligence," *Southeast Asian Math. Educ. J.*, vol. 7, no. 2, pp. 59–69, 2017, doi: 10.46517/seamej.v7i2.54.

[12] T. Rafida and E. Idayani, "The influence of guided inquiry learning strategies and learning motivation on the outcomes of islamic education learning in SMP Negeri 2 Bireuen," *Budapest Int. Res. Critics Institute-Journal*, vol. 4, no. 2, pp. 1945–1952, 2021, doi: 10.33258/birci.v4i2.1881.

[13] D. Yulia and N. Ervinalisa, "Pengaruh medai pembelajaran powtoon pada mata pelajaran sejarah indonesia dalam menumbuhkan motivasi belajar siswa IIS kelas X di SMA Negeri 17 Batam," *Hist. J. Progr. Stud. Pendidik. Sej.*, vol. 2, no. 1, pp. 15–24, 2018, doi: 10.33373/his.v2i1.1583.

[14] Y. D. Puspitarini, M. Akhyar, and Djono, "Development of video media Based on Powtoon in social sciences," *Int. J. Educ. Res. Rev.*, vol. 4, no. 2, pp. 198–205, 2019, doi: 10.24331/ijere.518054.

[15] M. W. Hasibuan and A. S. Anshor, "Development of powtoon animation learning media on flat building materials class IV," *Int. J. Educ. Res. Excell.*, vol. 2, no. 2, pp. 211–219, 2023, doi: 10.55299/ijere.v2i2.466.

[16] U. Razi, "The effect of using Powtoon on students' searning outcomes," *Int. J. Learn. Instr.*, vol. 3, no. 2, pp. 94–102, 2021, doi: 10.26418/ijli.v3i2.50651.

[17] Sugiyono, *Metode Penelitian Pendidikan*. Bandung: Alfabeta, 2010.

[18] S. M. Roni, M. K. Merga, and J. E. Morris, "Conducting research with children and student," *Conduct. Quant. Res. E ducation. Springer Singapore*, 2020, doi: 10.1007/978-981-13-9132-3_3.

[19] R. A. Madjid, "Pengaruh penggunaan media audio si juara terhadap hasil belajar IPA pada siswa tunanetra di MTSLB/ A Yaketunis Yogyakarta," pp. 305–314, 2019.

[20] A. A. Aziz, I. N. Hafawati Adam, J. Jasmis, S. J. Elias, and S. Mansor, "N-Gain and System Usability Scale Analysis on Game Based Learning for Adult Learners," in *2021 6th IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE)*, 2021, pp. 1–6, doi: 10.1109/ICRAIE52900.2021.9704013.

[21] I. G. Margunayasa, N. Dantes, A. A. I. . Marhaeni, and I. W. Suastra, "The effect of guided inquiry learning and cognitive style on science learning achievement," *Int. J. Instr.*, vol. 12, no. 1, pp. 737–750, 2019, doi: 10.29333/iji.2019.12147a.

[22] I. Kusmaryono and M. A. Basir, "Learning media projects with youtube videos : a dynamic tool for improving mathematics achievement," *Int. J. Eval. Res. Educ.*, vol. 13, no. 2, pp. 934–942, 2024, doi: 10.11591/ijere.v13i2.26720.

[23] E. P. Sekarsari and R. Rusnilawati, "The effect of team games tournament model-assisted articulate storyline media on improving outcomes and interest in learning javanese script material in elementary school," *Mimb. Sekol. Dasar*, vol. 10, no. 1, pp. 281–296, 2023, doi: 10.53400/mimbar-sd.v10i1.55262.

[24] Akrim, "Media learning in digital era," *Adv. Soc. Sci. Educ. Humanit. Res.*, vol. 231, no. 5th International Conference on Community Development (AMCA 2018), pp. 458–460, 2018, doi: 10.2991/amca-18.2018.127.

[25] M. H. R. Pais, F. P. Nogués, and B. R. Muñoz, "Incorporating powtoon as a learning activity into a course on technological innovations as didactic resources for pedagogy programs," *Int. J. Emerg. Technol. Learn.*, vol. 12, no. 06, pp. 120–131, 2017, doi: 10.3991/ijet.v12i06.7025.

[26] N. K. R. Barbara and G. W. Bayu, "Powtoon-based animated videos as learning media for science content for grade IV elementary school," *Int. J. Elem. Educ.*, vol. 6, no. 1, pp. 29–37, 2022.

[27] R. Rusnilawati, S. R. Bi. Ali, and M. H. M. Hanapi, "Impact of attitude category on problem-solving skills : An experiment within a flipped learning model with STEM approach," *Profesi Pendidik. Dasar*, vol. 10, no. 1, pp. 51–71, 2023, doi: 10.23917/ppd.v10i1.4267.