

Development of puzzle-based learning to improve science learning outcomes of Indonesian geographic conditions for fifth-graders

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Abstract : The lack of teacher ability to develop technology-based learning media and the lack of interaction in science and science learning activities result in less interesting learning and low student learning outcomes. This research aimed to develop learning puzzle media to determine its feasibility and effectiveness. The type of research used is research and development or Research and Development (R&D) which uses the research model design from Borg and Gall. There is a media and material validation process by expert lecturers. The subjects in this study were grade 5 students of Sekaran 01 State Elementary School, in the small-scale test there were 6 and in the large-scale test there were 20. The research method applied is the media development method, with data collection techniques that include observation, interviews, questionnaires, tests, and documentation. The research results show that material experts rate validation at 92%, and media experts rate it at 86%. The results of the n-gain trial obtained a cognitive n-gain score of 0.3030, with an average difference of 12. So, the n-gain score on the cognitive pretest and posttest learning outcomes on the large-scale trial was at a medium level, with a level of effectiveness amounting to 30.3030. The average increase shows that learning uses learning puzzles. Future research is expected to apply the media to simpler devices that can be used in a variety of classroom situations and have an easy-to-use and attractive appearance.

Keywords: Geographic, Learning Outcomes, Puzzle

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1. Introduction

Education is one of the important factors in the progress of a country and has a dynamic influence. Education has a strategic role in the development of Human Resources (HR) to create a society that is skilled, creative, innovative, and expert in its field and able to compete at the global level (Parinduri et al., 2022; Suparman, 2023; Yuliani & Setiawan, 2024). From there we know that education is an important aspect of improving the quality of life (Setiawan & Septiyani, 2023). Education is also defined as the activities of a group of people or institutions in helping individuals or groups of people to achieve educational goals (Nur Saputra et al., 2021). In achieving directed education must be aligned with national education goals and the need for a qualified education curriculum (Mahya & Setiawan, 2024).

The new curriculum design is an independent curriculum and is used as a national curriculum (Angga et al., 2022). Curriculum renewal is carried out as an effort to improve aspects of learning and the quality of education in schools, which leads to better quality education (Masykur, 2020). The curriculum can help in achieving learning objectives, content, and methods including developing student potential (Ahmad Dhomiri et al., 2023). The curriculum as a set of plans and arrangements is the basis for compiling learning materials and selecting appropriate learning media (Setiadi & Andriani, 2024).

The new Merdeka Curriculum that combines science with social studies is a challenge for teachers and students (Ikhsani & Alfiansyah, 2023). This is the basis for preparing students to study more complex science and social studies at the junior high school level (Cahyani, 2023). Participants are taught to see natural and social phenomena in an integrated manner when studying the surrounding environment, so that they will be accustomed to carrying out inquiry activities, such as observing and exploring. This is very important as a foundation for them to learn deeper concepts in science and social studies subjects at the junior high school level (Anggraena, et al., 2022). By the theory of student development, the MI/SD age is a strategic age for developing children's inquiry skills (Hasmira, 2023). Science and social studies subjects are combined into IPAS on the basis that science and social studies are the development of scientific inquiry/thinking skills (Bayat et al., 2023). Science and social studies learning gives students the freedom to become active and responsible individuals in solving problems that are relevant to everyday life and cannot be solved with just one discipline (AtKisson, 2012), by combining science and social studies subjects, it is hoped that it can help children to think holistically (Kemendikbud, 2022).

A way to facilitate the delivery of material in social studies learning in elementary schools is to use innovative, appropriate, and effective learning media, which are expected to attract students' interest in learning and improve students' understanding of abstract things contained in social studies material (Dianti et al., 2023; Wulandari et al., 2023). The right learning media can stimulate students' thinking power and psychomotor abilities (Fahriyanti et al., 2021). Media use in the learning process is one effort to create more meaningful and quality learning. With interactive, fun, challenging, and motivating learning media, varied learning can be carried out and can increase student learning activities (Wahidin, 2017). This is explained by Nurwahidah et al (2021) who stated that student learning motivation and attention will increase, one of which is by using learning media (Juniarti et al., 2021). Learning media can be in the form of visual and audio-visual media that can overcome boredom and achieve learning goals optimally (Mulyanto & Mustadi, 2023; Rahmi et al., 2019; Wayan Kandia et al., 2023).

In learning in the field, it is known that there are several problems, including limited learning media in schools and also the use of less innovative learning media (Nurdyansyah, 2019). In contrast, students must clearly understand the concepts taught by their teachers. This problem causes students' interest in learning to be low, considering that social studies subject matter is mostly about memorization (Khoirul Taufiq et al., 2023). Students often think that learning social studies tends to be boring compared to other subjects (Wiguna Chandra et al., 2022). This results in the value of the social studies subject being lower than several other subjects. Apart from that, another factor that influences students' low interest in learning is that learning is teacher-centred when learning is carried out online and face-to-face on a limited basis (Prayogi et al., 2014).

Based on the results of the researcher's interview with the class V teacher, SD Negeri Sekaran 01, class V has used the independent curriculum. One of the materials that is difficult for students to understand is IPAS Phase C, CHAPTER 6 Indonesiaku Kaya Raya, material about Geographical Location. The difficulties experienced by students are due to the large amount of memorized material and students' lack of interest in reading, so Geographical lessons are less popular with students. The learning process in the classroom is only directed at the child's ability to memorize information.

The social studies teaching and learning process in schools is generally considered uninteresting; as a result, many schoolchildren are less interested in studying social studies subjects. Apart from that, social studies subjects are not that important, so students in the teaching and learning process are not very serious about following them (Nur Auliah et al., 2023). Several indicators that show that social studies subjects could be more interesting and important are that social studies subjects' grades are not very high. Therefore, to speed up understanding and avoid misunderstandings, appropriate teaching approaches and

media are needed, by the level of mental maturity of students (Magdalena et al., 2021). Apart from that, the problem that occurs in the field is that learning is still teacher-centered, so students become passive when the learning process takes place. Because of the many problems experienced when carrying out a learning process, a breakthrough in learning is needed in the form of effective and enjoyable learning media (Luqman Hakim et al., 2024).

This study is also strengthened by several previous relevant studies, including research conducted by Asmawati (2023) obtained differences in children's learning outcomes before and after using puzzle games for Early Childhood Based on Banten Regional Culture. Based on research by Widyatmoko (2019) revealed that the media was stated to be interesting and recommended for use on the theme 4 My Rights and Obligations for grade III Elementary School using Flash media. According to Zamhari et al (2023) with the help of TAPUBA puzzle media with the Research and Development (R&D) method, it received teacher and student assessments of 89.06% and 95.00% in the very good category. Research by Riskyka et al (2023) obtained the results of the validity of puzzle media with a game-based learning approach, obtaining an average score from material experts and media experts of 4.29 and 4.17 with the categories "very valid" and "valid". Then research by Alika and Radia (2021) the results of the Cross Puzzle game assessment are valid and suitable for use as a learning medium to improve student learning outcomes. This study received a response from teachers with a score of 98.6% and a response from students with an average score of 86.7% in the practical or very good category for use (Ziliwu & Anas, 2024).

Based on previous research, the novelty of this research lies in the subject matter studied, which focuses on social studies subjects, especially material on the geographical conditions of Indonesia in the chapter on maps, map elements, Indonesia as a maritime country and an agricultural country, then puzzle media is made and designed using Adobe Photoshop CS6 so that the image looks more natural. Then, the puzzle is made more straightforward for 5th grade elementary school students by printing using MDF (Medium Density Fibreboard) wood which is light and safe for children. Based on the problems above, the researcher wants to know the feasibility of learning puzzle learning media. The author chose learning puzzles in this study because puzzles can be used to convey information. The puzzle about the location of the islands in Indonesia, will provide an accurate picture of the islands that have not been memorized by students. Students who will learn the use of puzzle learning media in science subjects through development research can better understand this because students not only assemble puzzles but must answer the questions on the question cards and the answers to the question cards are on the puzzle pieces. Based on this background, the researcher will discuss three problem formulations, including: (1) the design of puzzle-based learning media, (2) the feasibility of puzzle-based learning media, and (3) the effectiveness of puzzle-based learning media in improving learning outcomes for IPAS for class V at SDN Sekaran 01 Semarang.

2. Materials and Methods

This research is included in the type of research and development or is usually considered Research and Development (R&D). Research and development methods are research methods used to produce certain products and test their effectiveness. The product developed in this research is a learning puzzle for fifth-grade students to learn and memorize geography in Indonesia in a fun way. This research uses the Borg and Gall development model (Sugiyono, 2016). The implementation stage includes: (1) potential and problems; (2) data collection; (3) product design; (4) design validation; (5) design revision; (6) testing product (7) revision product; (8) operational product testing; (9) final product revision; and (10) mass product as in Figure 1 (Devra Raihan et al., 2023).

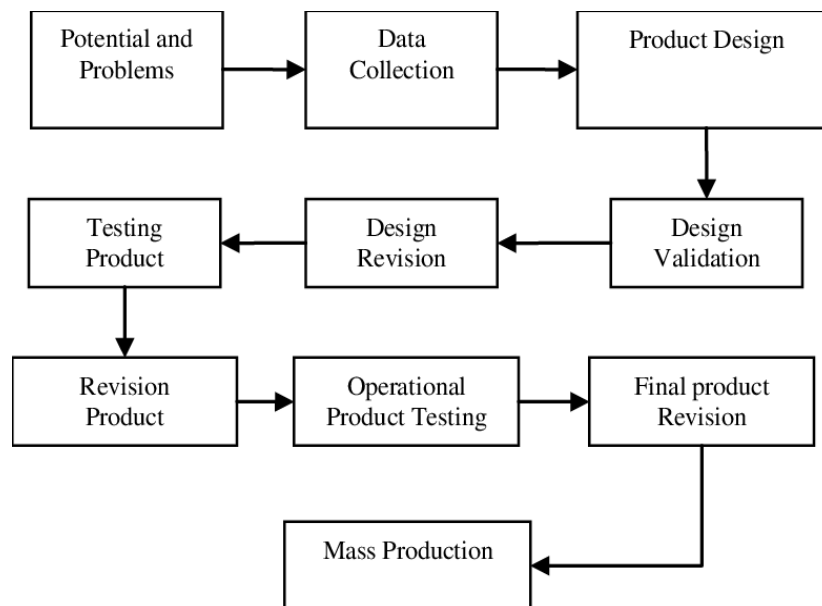


Figure 1. Research Method Flow

The initial process of development research begins with an analysis of the problems and needs that exist at SDN Sekaran 01. At this stage, the researcher conducted observations to identify potential problems in class V of SDN Sekaran 01. The researcher also conducted interviews and observations to explore problems in students' understanding of the material *Indonesiaku Kaya Raya* material about Geographical Location. Furthermore, the researcher conducted a needs analysis using a needs questionnaire that was distributed to teachers and students. The data obtained from the needs questionnaire became the basis for Puzzle-based Learning.

In the second step, the researcher collected data. The problems in the pre-research stage were considered potential problems that then allowed the researcher to collect various information related to learning media that could support them. From the information collected, the researcher found a learning media, namely Puzzle-based Learning.

In the third stage, namely the product design process, the researcher designed the initial design by carefully and completely assembling the existing components. However, the product design that has been prepared can still experience changes, additions, or reductions according to the results of validation by experts and field trials.

In the fourth stage, the researcher validated the design. This validation process aims to evaluate the effectiveness of the product design. The researcher involved two experts, namely material experts and media experts, to provide input and suggestions for the Puzzle-based Learning media. This is done so that the product developed is to the needs and characteristics of students.

In the fifth stage, namely product revision, the researcher then made revisions according to the assessment obtained. This aims to produce better Puzzle-based Learning media.

In the sixth stage, the researcher conducted a product trial. To collect data as a basis for determining whether or not the product is feasible in terms of suitability and use in completing the learning period. Product trials are carried out with small-scale trials and large-scale trials.

In the seventh stage, namely product revision. Puzzle-based Learning media that has been tested by experts and received responses from students and teachers will be revised if it is not by expectations until it becomes a product that is feasible to use in learning.

In the eighth stage, the researcher conducted a usage trial. The researcher conducted a re-trial of the product to be developed to determine the feasibility of the product. Large-scale trials can be carried out with the same teachers as the second trial. The researcher used Puzzle-based Learning media directly in class in learning. That way the researcher can determine the effectiveness of the product.

The ninth stage is product revision. At this stage, researchers make improvements to the developed product if it still needs to be improved. This is done to obtain development product results that are truly feasible and can be used in the field to help students.

The tenth stage is mass production related to the media developed to produce learning media in large quantities.

Research data collection regarding the development of the learning media Learning Puzzle was carried out by direct observation in class V of SD Negeri Sekaran 01. The results of the observations showed low student science learning outcomes, a lack of development of learning media, and innovation in the use of learning media. The research subjects were 20 fifth-grade students at SD Negeri Sekaran 01. The data analysis techniques used a questionnaire instrument to determine the results of media use and assess the suitability of the media, a test instrument to evaluate cognitive learning outcomes (BatuBara et al., 2021).

The following the provisions (Formula 1) of Arikunto (2014), while the Criteria for Teacher and Students Needs Questionnaire are as in Table 1 (Wulandari & Ratnawati, 2024).

$$P = \frac{\sum x}{\sum xi} \times 100 \tag{1}$$

Information:

- P = Score Percentage
- Sx = number of respondents' answer scores in one item
- Σxi = the sum of the ideal scores in one item

Table 1. Criteria for Teacher and Students Needs Questionnaire

Percentage (%)	Criterion
81 – 100	Agree
61 – 80	Agree
41 – 60	Disagree less
21 – 40	Disagree
0 – 20	Strongly disagree

Analysis of Teacher and Students Responses to Media using the Likert scale There are 5 categories used, namely 1 (strongly disagree), 2 (disagree), 3 (quite agree), 4 (agree), and 5 (strongly agree). We follow the Formula 1 (Arikunto, 2014), while the Teacher Response Questionnaire Criteria are as in Table 2 (Gentala & Dasar, 2018).

Table 2. Teacher Response Questionnaire Criteria

No.	Percentage (%)	Criterion	Information
1.	81 – 100	Excellent	The media is very feasible, it does not need to be revised
2.	61 – 80	Good	Decent media does not need revision
3.	41 – 60	Good enough	Less decent media needs revision
4.	21 – 40	Not good	Inappropriate media needs revision
5.	< 20	Very unfavourable	The media is very unworthy of revision

According to the provisions of [Arikunto \(2014\)](#) as in [Formula 2](#), while the Students' Response Questionnaire is as in [Table 3 \(Gentala & Dasar, 2018\)](#).

$$P = \frac{F}{N} \times 100 \tag{2}$$

Information:

- P = percent value of interest in learning using media
- F = the frequency with which the percentage is searched
- N = maximum number of scores

Table 3. Students Responses Questionnaire Criteria

No.	Score Percentage (%)	Criterion
1.	81 – 100	Very interesting
2.	61 – 80	Pull
3.	41 – 60	Quite interesting
4.	21 – 40	Less attractive
5.	< 20	Unattractive

Students' cognitive learning outcomes can be compared with the results before and after treatment by assessing their scores ([Hikmah et al., 2023](#)). In this research, the normality test is used to determine whether the data is normally distributed. Said that the data normality test is important because data with a normal distribution can represent the population ([Pratama et al., 2021](#)). In this study, researchers used the normality test with Kolmogorov-Smirnov in SPSS version 23 to determine whether the data was normally distributed ([Table 4](#)) with the assumption that ([Priyatno, 2018](#)).

Table 4. Normality Test Criteria

Result	Information
If the significance value is $0.05 \leq$	Ho was rejected
If the significance value > 0.05	Ho accepted

A paired samples T-test, also known as a paired-sample t-test, is performed next to determine the difference in means between two paired samples. As stated by [Priyatno](#), paired samples are used in sample groups that involve the same subjects but have received two different treatments, namely before and after treatment. Researchers used SPSS version 23 with the paired sample t-test to evaluate the results before and after treatment. For parametric data that is normally distributed, this t-test can be used (see [Table 5](#) and [Table 6](#) with provisions referring to ([Priyatno, 2018](#))).

Table 5. Paired Samples T-Test Criteria

Result	Information
If -t calculate -t table or greater or \geq t calculate t table \leq	Ho accepted
If -t calculate -t table less < t calculate t greaterble >	Ho was rejected

Table 6. Decision Making Based on the Significance of the Paired Samples T-Test

Result	Information
If the significance value is $0.05 \leq$	Ho was rejected
If the significance value > 0.05	Ho accepted

The Wilcoxon test is also used to determine the average of two paired samples if the data is not normally distributed; it is used on nonparametric data rather than the paired-samples t-test. The data used is ordinal or interval data, as shown in [Table 7](#) and [Table 8](#), with provisions referring to. Researchers can carry out the Wilcoxon test in this research using SPSS version 23.

Table 7. Decision-Making in the Wilcoxon Test

Result	Information
If the significance value < 0.05	Ha accepted
If the significance value > 0.05	Ha rejected

Followed by analysis of the gain index, which is used to determine the pre-test and post-test scores. The gain referred to in this research is normalized gain (N-gain), as in [Table 8](#). Normalized gain is obtained by comparing the difference in pretest and post-test scores with the difference in the Ideal Minimum Score (SMI) and pretest on the subject content of the geographical conditions of Indonesia. Normalized profits as shown in [Formula 3](#).

$$N - Gain = \frac{posttest - pretest}{Maximum\ Score - pretest} \tag{3}$$

Information:

- N-Gain = magnitude of gain factor
- Skor Posttest = final test score after treatment
- Skor pretest = initial value before treatment
- Maximum score = maximum value

Table 8. Test Average Gain (N-Gain)

Interval	Criterion
N-Gain $0.7 \geq$	Tall
0,3 N-Gain $0,7 \leq$	Keep
N-Gain < 0.3	Low

3. Results

3.1 Product data analysis

The majority of students so far think that maps are symbols that are unpleasant and difficult to relate to. Therefore, the researchers designed it in such a way that it becomes a game in the form of a puzzle. The puzzle form applied in this research is the Indonesian map puzzle. Learning puzzle media was developed through the analysis of potential problems, where researchers directly observed the learning process and interviewed teachers and students. Based on interviews, the problem faced by fifth-grade students at SDN Sekaran 01 is the lack of use of various media and students not yet memorizing the location of the island. Time constraints and inadequate facilities at school are factors that cause low use, according to the fifth-grade teacher as the resources Pearson. Then, formulating the product design, this Indonesian map puzzle was designed using the Adobe Photoshop CS6 application, which is specifically for editing photos or images and creating effects. The Indonesia map puzzle display is designed to be as attractive as possible with an animated marine theme, with lots of colors and writing adapted to the shape of the islands in Indonesia. The question cards were well designed using the Canva application, with maritime and agricultural country themes adapted to the material (see [Figure 2](#), [Figure 3](#), [Figure 4](#) and [Figure 5](#)).



Figure 2. Geographical Map of Indonesia



Figure 3. Map Puzzle

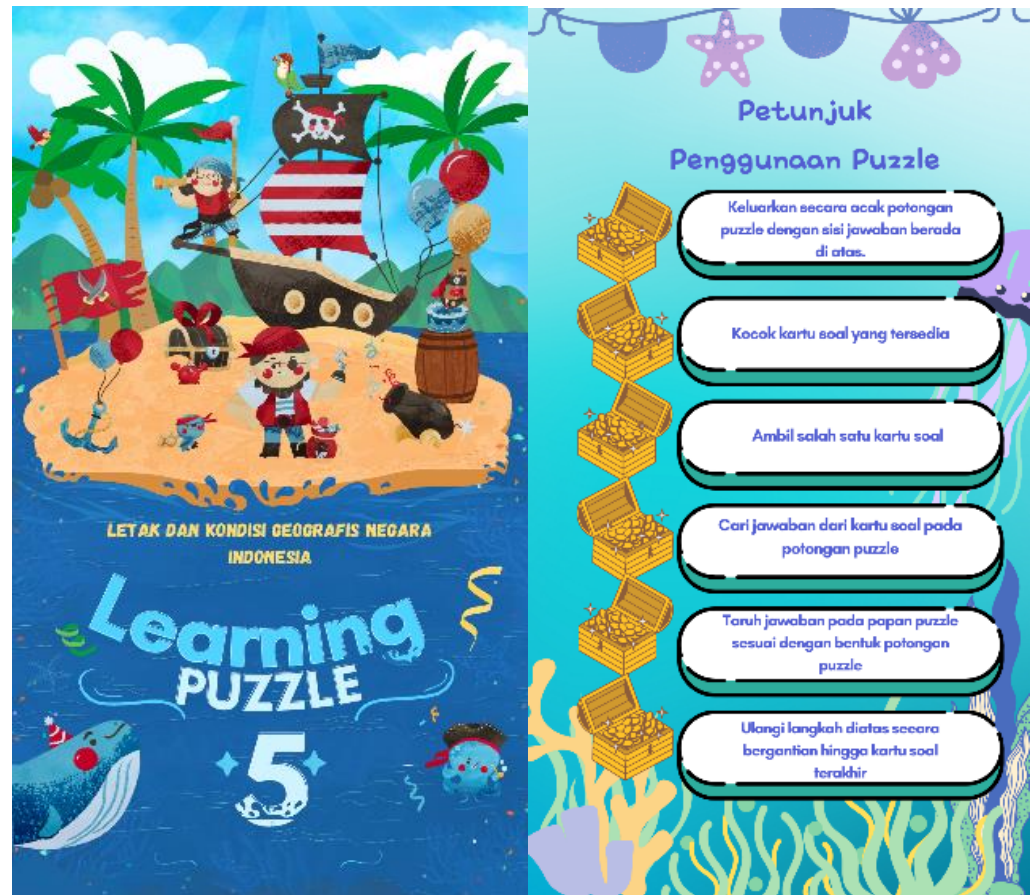


Figure 4. Cover Media Figure 5 Instruction



Figure 5. Evaluation

Before being tested on students, the media and materials that have been prepared must be validated. Media experts and material experts assessed the suitability of the puzzle-learning media, and then the results of the research were used as material for improving the puzzle-learning media. Researchers pay attention to suggestions and input given by media experts regarding media design. Advice from media experts is very important to suit the media that will be used before the trial stage. After the media design revision stage, there was a small-scale trial stage where this research was carried out at

SDN Sekaran 01 class V with a total of 6 students. For the first meeting, there was a pretest, then continued with material on map elements which used media that had been prepared. For the second meeting, there was material on maritime and agricultural countries, followed by work on the posttest.

3.2 Product Validation

Next, the media design and components are assessed by a media expert validator using a validation instrument, which includes 2 question indicators, namely: (1) Learning puzzle display and (2) Presentation of learning puzzles.

The results of the assessment of the feasibility of the design and media presentation components gave several points 4 and mostly points 3 for each aspect that was assessed as a presentation of the feasibility of the media presentation which was obtained, namely 86% belonging to the very feasible criteria. The results of the assessment of the appropriateness component of the material content of the learning puzzle media by material experts received a positive response, and a presentation of 92% was obtained with very appropriate criteria with a note of improving several aspects of the learning material. The results of the recapitulation of the media and material expert assessments can be seen in [Table 9](#).

Table 9. Recapitulation of Validation of Assessment of Feasibility Components of Learning Puzzle Media

Validation	Percentage Score	Criteria
Media Expert	86%	Very Worth It
Materials Expert	92%	Very Worth It
Average	89%	Very Worth It

The learning puzzle learning media developed by researchers is considered very worthy of trying, with material validation results of 92% in the "very feasible" category and media validation results of 86% in the "very feasible" category.

3.3 Analysis of Teacher and Students Needs Questionnaire

Interviews with people involved in observation activities at school are the initial data source. As a result of the teacher's initial analysis, it can be concluded that the teacher faces difficulties conveying material on Indonesia's geographical conditions, especially material related to the map section. As a result, teachers experience difficulties in delivering the material, which causes low student learning outcomes. The absence of learning resources supporting classroom learning is a significant problem component. The researcher continued by surveying what teachers and students need to solidify the idea of learning media. The survey results regarding teacher and student needs are presented in [Table 10](#).

Table 10. Result of the Teacher and Students Need Questionnaire

Teacher/Student	Percentage
Teacher	81%
Student	79%
Average	80%

Table 10 shows the results of the teacher and student needs questionnaire. The average result of the questionnaire was 80% agree with the criteria of strongly agree for the development of learning media for Indonesia's geographical conditions.

3.4 Analysis of Teacher and Students Responses to the Media

The results of the teacher and student response questionnaire after testing the use of puzzle learning media are presented in Table 11. The purpose of filling out the teacher and student response questionnaire is to find opinions and comments regarding using puzzle learning media.

Table 11. Result of the Teacher Response Questionnaire

Teacher	Percentage
Class Teacher	100%
Average	100%

The results of the teacher response questionnaire show the teacher's reaction to the learning puzzle learning media regarding the geographical conditions of Indonesia. On average, the teacher's reaction to the learning puzzle learning media treatment was 100% and met the very appropriate criteria without revision. The results of the student response questionnaire also show the teacher's reaction to the learning puzzle learning media. The results of limited and extensive testing produced average student results. The results of limited trials averaged 85%, and the results of wider trials averaged 96%, so that the average student results were 90.5%, meeting the criteria (Table 12).

Table 12. Students Response Questionnaire Result

Limited Trial Results	Results of Extensive Trials	Average
85%	96%	90.5%

3.5 Analysis of Small Group Test

The results of the Small Group Test after testing the use of puzzle learning media are presented in Table 13.

Table 13. Ngain Small Group Test

	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Std. Deviation
ngain_score	6	.19	.46	.3097	.11162
ngain_persen	6	18.52	46.00	30.9731	11.16232
Valid N (listwise)	6				

The results of the small group n-gain test are presented in Table 13. Based on the calculation of the average increase test (N-Gain) in the limited trial, it is known that there is an average increase of 0.30, which is included in the small group. In medium criteria.

3.6 Initial Data Analy

The normality test is carried out to determine whether the distribution of pretest and posttest learning outcomes is normal. Normality tests can help researchers choose what data analysis methods to use from the data they collect. Parametric statistical methods will be used for data with a normal distribution. The normality test used the Shapiro-Wilki test formula and the SPSS version 23 program.

3.7 Normality Test

Next, a media effectiveness test was carried out through pretest and posttest scores for class V SD Negeri Sekaran 01. From the research results, initial data was obtained, and then an analysis of the normality test of the pretest and posttest scores was carried out. The use of the normality test is to detect whether the data obtained in the population is

normally distributed or not so that the data is normally distributed. In the normality test, this research used the Liliefors test with the help of SPSS 23. Based on Table 14, the pretest and posttest results are normally distributed with a significance value of $0.231 > 0.05$. This shows that the normality assumption is met and the values of H_0 and H_1 are rejected. Therefore, it can be concluded that the learning outcomes after the test are normally distributed.

Table 14. Normality Test Result on Wide Trials

	Tests of Normality					
	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.185	20	.070	.932	20	.169
Posttest	.176	20	.106	.939	20	.231

a. Lilliefors Significance Correction

After carrying out the normality test, it is continued with the t test. The paired samples t test, also known as the paired samples t test, is used to measure the difference between pretest and posttest mean scores as well as the difference between pretest and posttest learning. The following are the results of using the learning puzzle.

3.8 T-Test

Whether there is a significant difference between the average scores before and after student treatment is tested using the t-test or t-test. The method is the t-pair test or a test between two parties. Since this test uses two paired samples, this decision was made. These tests were carried out using the SPSS version 23 program. The results of the Paired Sample T-test on large groups are shown in Table 15.

Table 15. T-test Result on Wide Trials.

	Paired Differences						t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Pair 1 Pretest - Posttest	-12.000	9.375	2.096	-16.388	-7.612	-5.724	19	.000	

Table 15 shows the results of the t-test on the pretest and posttest, each of which is 0.00, which shows that H_0 is rejected because $0.00 < 0.05$. Thus, the t-test results produced after using the learning puzzle learning media show that there is a difference between the average pretest score and post-test score. With an increase in learning of 12%, it can be concluded that the data was obtained because the difference in pretest and posttest scores was less than zero, so the pretest score was smaller than the posttest score.

3.9 N-gain Test

Next, an n-gain test was carried out to determine the increase in pretest and posttest scores. Therefore, there were categories of low, medium, or high pretest and posttest scores. According to Table 16, the pre-test and post-test n-gain each reached a value of 0.3030, which places it in the medium category. However, to estimate effectiveness, student learning scores show an increase in the Very Effective criteria with an average score of 30.3030.

Table 16. N-Gain Test Result on Wide Trials (Descriptive Statistic)

	N	Descriptive Statistics			
		Minimum	Maximum	Mean	Std. Deviation
ngain_score	20	-.50	.75	.3030	.32517
ngain_persen	20	-50.00	75.00	30.3030	32.51716
Valid N (listwise)	20				

4. Discussion

Learning puzzle learning media was developed to show (1) Product development, (2) Product feasibility, and (3) The effectiveness of learning media for class V IPAS material. This puzzle design was designed using Adobe Photoshop, then went through the printout stage and then attached to wood that had been designed in cut shapes to be attached to the puzzle board. With a marine theme as a background, it functions so that students always remember that Indonesia is a maritime country and consists of various islands. The next step is to design question cards using the Canva application, which function as questions in the puzzle. The final step is to create answers to the questions on the question cards to be attached to the back of the puzzle. Children are encouraged to be creative and develop their ideas, understanding, and language skills through play (Yogica et al., 2020). Games allow them to research, apply, and test what they know.

The results of the validator team's expert validation determine the suitability of the learning puzzle learning media (Aini et al., 2023). The purpose of this feasibility test is to determine whether the learning puzzle learning media can be used as a learning media for class V science and provide input or recommendations for media development (Nurdyansyah et al., 2020). Based on the results of the validator team's expert validation, the accumulated rating used as a percentage in the material expert test was 92%. In comparison, the expert media was 86%, indicating that learning puzzles are very suitable to be used as learning media in the context of science and geographical conditions subjects.

The effectiveness of this puzzle learning media can be determined based on the pretest and posttest results from a large-scale trial at SDN Sekaran 01 involving 20 students in class V (Simanungkalit et al., 2023). The average pretest score was 61, with only 20 students meeting the Minimum Standards for Completeness, and the average posttest score was 73 with 20 students. These results show how effective the use of learning media is for class V IPAS material. The Shapiro-Wilk test was used on pretest and posttest learning outcomes data for the large group of trials. The calculation results show a sig value of 0.169, based on the assumption that a sig value > 0.05 indicates a normal data distribution. Therefore, the sig value is $0.169 > 0.05$, so it can be concluded that posttest student learning outcomes are normally distributed.

Next, after the data was normally distributed, the researcher used a paired t-test to check the differences between the pretest and posttest. Based on calculations, the mean pretest and posttest scores are 61% and 73% with a significance of $0.00 < 0.05$, indicating a relationship with increasing learning outcomes with an increase of 12% so that there is a difference in scores on the pretest and posttest in large groups using trial testing.

The researcher then calculated the n-gain test. From this test, the researchers found a cognitive n-gain score of 0.3030 with an average difference of 12. Therefore, the n-gain value on the cognitive pretest and posttest learning outcomes in the large group use trial were in the medium category, with a level of effectiveness of 30.3030. According to the results of the paired t-test and n-gain test, learning puzzle learning media is effective when used as learning media (Wahab et al., 2021).

Improving student learning through the use of puzzle-learning media has been confirmed by several previous studies, which state that there is an increase in learning outcomes after using puzzle-learning media. This is proven by several previous studies from the figure (Abdulah et al., 2020) obtained the utilization of puzzle learning media is

in the good category and is appropriate as an alternative media that can help the learning process well in the subject of Basic Building Construction at SMKN 1 Sumedang. Research by the figure (Abdjul et al., 2024) obtained results with the ADDIE research steps, the results of the study showed that interactive learning media crosswords integrated with virtual laboratories are categorized as valid, practical, and effective because they combine learning and games so as to provide a deep and enjoyable learning experience for users. The results of the study showed that the relevance score of Gema Cow-Pu learning media with students' critical thinking skills was in the very valid category with an average score of 89.75 percent, and Practical with a percentage of 95.3% (Darmayanti, 2023). Based on research by Maulidah and Aslam (2021) a significant influence on the learning outcomes of Natural Sciences (IPA) by using puzzle media in elementary school students. The use of Puzzle media in mathematics subjects in Taeng-Taeng, Gowa Regency has a positive influence on improving student learning outcomes (Bahar & Risnawati, 2019). According to Anindita et al (2018) an effectiveness of talking stick model assisted with puzzle media on science learning outcomes on the theme "ecosystem" of grade v SDN Jatingaleh 01.

So, based on this research, the use of learning puzzle learning media to support learning the results of class V IPAS material both classically and independently can be considered appropriate and able to overcome existing problems, especially in terms of increasing learning independence and increasing students' understanding of the concept of maps and Indonesia. as a maritime and agricultural country.

5. Conclusion

This research uses concrete puzzle media as a learning medium, which is designed using Adobe Photoshop and then attached to a customized wooden board. Then, the puzzle can be used as a concrete medium for class V science geographic conditions material. The expert validator team tested the feasibility of learning the puzzle learning media; material experts rated 92%, and media experts rated 86%. The learning puzzle media depicting the map of Indonesia is very feasible and can be tested on students, according to the assessment of the validator team. Analysis of normality results: A sig value of 0.169 was obtained from pretest and posttest data, with the assumption that a sig value > 0.05 indicates that the data is normal. Based on the results of the n-gain trial, a cognitive n-gain score of 0.3030 was obtained, with an average difference of 12. So, the n-gain score on the cognitive pretest and posttest learning outcomes on the large-scale trial was at a medium level, with an effectiveness of 30.3030. The average increase shows that learning uses learning puzzles. Future research is expected to apply media to simpler devices that can be used in a variety of classroom situations and have an easy-to-use and attractive appearance. This will help character development according to the new curriculum.

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6. References

- Abdjul, T., Yusuf, M., & Nurhayati. (2024). Development of interactive learning media crossword puzzle integrated virtual laboratory in science learning vibrations and waves material. *Jurnal Penelitian Pendidikan IPA*, 10(8), 5662–5672. <https://doi.org/10.29303/jppipa.v10i8.8414>
- Abdulah, T., Widaningsih, L., & Minggra, R. (2020). Puzzle game development as a learning media in learning outcomes of building construction basics. *IOP Conference Series: Materials Science and Engineering*, 830(4), 042061. <https://doi.org/10.1088/1757-899X/830/4/042061>
- Ahmad Dhomiri, Junedi Junedi, & Mukh Nursikin. (2023). Konsep dasar dan peranan serta fungsi kurikulum dalam pendidikan. *Khatulistiwa: Jurnal Pendidikan Dan Sosial Humaniora*, 3(1), 118–128. <https://doi.org/10.55606/khatulistiwa.v3i1.972>
- Aini, K., Rosidi, I., Muharrami, L. K., Hidayati, Y., & Wulandari, A. Y. R. (2023). Uji Kelayakan media pembelajaran videoscribe berbasis animation drawing menggunakan model ADDIE pada materi pencemaran lingkungan. *Natural Science Education Research*, 6(1), 112–121. <https://doi.org/10.21107/nser.v6i1.11527>
- Alika, O., & Radia, E. H. (2021). Development of learning media based on cross puzzle game in science learning to improve learning outcomes. *Jurnal Penelitian Pendidikan IPA*, 7(2), 173–177. <https://doi.org/10.29303/jppipa.v7i2.667>
- Angga, A., Suryana, C., Nurwahidah, I., Hernawan, A. H., & Prihantini. (2022). Komparasi implementasi kurikulum 2013 dan kurikulum merdeka di sekolah dasar Kabupaten Garut. *Jurnal Basicedu*, 6(4), 5877–5889. <https://doi.org/10.31004/basicedu.v6i4.3149>
- Anggraena, Y., Ginanto, D., Felicia, N., Andiarti, A., Indriyanti, H., Alhapip, L., & Setiyowati, D. (2022). *Panduan pembelajaran dan asesmen kurikulum 2013: Pendidikan anak usia dini, pendidikan dasar, dan menengah*.
- Anindita, H., Nuroso, H., & Reffiane, F. (2018). Keefektifan model talking stick berbantu media puzzle terhadap hasil belajar IPA tema “ekosistem” kelas V SDN Jatingaleh 01. *JS (Jurnal Sekolah)*, 3(1), 10. <https://doi.org/10.24114/js.v3i1.11622>
- Arikunto, S. (2014). *Prosedur penelitian suatu pendekatan praktek*.
- Asmawati, L. (2023). The development of puzzle games for early childhood based on the Banten local culture. *Jurnal Ilmiah Peuradeun*, 11(2), 531. <https://doi.org/10.26811/peuradeun.v11i2.895>
- AtKisson, A. (2012). *The sustainability transformation*. Routledge. <https://doi.org/10.4324/9781849775700>
- Bahar, B., & Risnawati, R. (2019). Pengaruh penggunaan media puzzle terhadap hasil belajar matematika siswa kelas III SD di Kabupaten Gowa. *Publikasi Pendidikan*, 9(1), 77. <https://doi.org/10.26858/publikan.v9i1.8446>
- BatuBara, Y. A., Zetriuslita, Z., Dahlia, A., & Effendi, L. A. (2021). Analisis minat belajar siswa menggunakan media pembelajaran e-comic aritmatika sosial masa pandemi Covid-19. *Jurnal Derivat: Jurnal Matematika Dan Pendidikan Matematika*, 8(1), 1–10. <https://doi.org/10.31316/j.derivat.v8i1.1518>
- Bayat, P. A., Nusantara, T., & Suciptaningsih, O. A. (2023). Development of gamification-based digital flipbook meldia on ipas material (study on grade IV elementary school). *International Education Trend Issues*, 1(3), 262–275. <https://doi.org/10.56442/ieti.v1i3.273>
- Cahyani, A. (2023). Peningkatan hasil belajar ipas siswa kelas V SDN 2 talesan dengan penerapan model pembelajaran Pjbl melalui media diorama. *Jurnal Jaringan Penelitian Pengembangan Penerapan Inovasi Pendidikan (Jarlitbang)*, 137–144. <https://doi.org/10.59344/jarlitbang.v9i2.151>
- Darmayanti, R. (2023). Gema Cow-Pu: Development of mathematical crossword puzzle learning media on students’ critical thinking ability. *Assyfa Learning Journal*, 1(1), 37–48. <https://doi.org/10.61650/alj.v1i1.1>

- Devra Raihan, P., Wardani, S., & Isdaryanti, B. (2023). Development of teaching materials based on multiple intelligences with project based learning to increase creativity and science learning outcomes for grade VI Elementary school students in Semarang city. *International Journal of Research and Review*, 10(6), 318–328. <https://doi.org/10.52403/ijrr.20230639>
- Dianti, P., Maretha Juana Imamah, P., & Ajnihatimmastna, Y. (2023). *Penguatan pembelajaran melalui penggunaan media pembelajaran kreatif dan inovatif*.
- Fahriyanti, A. J. E., Prasetya, C. I., & Wantoro, R. (2021). Pengembangan media “Klik Aja” dalam pembelajaran daring menyampaikan teks berita bagi siswa kelas VIII. *MARDIBASA: Jurnal Pembelajaran Bahasa Dan Sastra Indonesia*, 1(2), 385–417. <https://doi.org/10.21274/jpbsi.2021.1.2.385-417>
- Gentala, J., & Dasar, P. (2018). *Attribution-noncommercial-sharealike 4.0 international license some rights reserved | Page Article Information*. 3(2). <http://online-journal.unja.ac.id/index.php/gentala>
- Hasmira, H. (2023). *model pembelajaran inkuiri dalam pembelajaran anak usia dini*. <http://jiip.stkipyapisdmpu.ac.id>
- Hikmah, D., Hadi, W. P., Sidik, R. F., Qomaria, N., & Yasir, M. (2023). Penerapan model pembelajaran scramble terhadap hasil belajar kognitif siswa. *Natural Science Education Research*, 6(1), 50–56. <https://doi.org/10.21107/nser.v6i1.16492>
- Ikhsani, N. M. I., & Alfiansyah, I. A. (2023). Persepsi guru terkait implementasi kurikulum merdeka di sekolah dasar pada mata pelajaran IPAS. *Jurnal Elementaria Edukasia*, 6(4), 1597–1608. <https://doi.org/10.31949/jee.v6i4.7132>
- Juniarti, W., Affandi, L. H., & Husniati. (2021). Pengembangan media pembelajaran IPS card match circle untuk kelas IV SDN 36 Ampenan. *Jurnal Literasi Dan Pembelajaran Indonesia*, 1(1), 25–34.
- Kemendikbud. (2022). *Hal-hal esensial kurikulum merdeka di jenjang SD*. <https://ditpsd.kemdikbud.go.id/artikel/detail/hal-hal-esensial-kurikulum-merdeka-di-jenjang-sd>
- Khoirul Taufiq, M., Khotimah, K., Prastiyono, H., Khotimah, M., & Prastiyono, K. (2023). Pengembangan media pembelajaran komik digital pada pembelajaran IPS terhadap minat belajar siswa SMP. In *Dialektika Pendidikan IPS* (Vol. 3, Issue 2).
- Luqman Hakim, M., Trilisia, N., & Prabowo, M. (2024). *Pembelajaran yang efektif, efisien, dan menyenangkan dengan media pembelajaran bagi guru sekolah dasar di wilayah koordinator pendidikan Bulu Sukoharjo*. 9(2), 195–199.
- Magdalena, I., Fatakhatus Shodikoh, A., Pebrianti, A. R., Jannah, A. W., Susilawati, I., & Tangerang, U. M. (2021). Pentingnya media pembelajaran untuk meningkatkan minat belajar siswa SDN Meruya Selatan 06 Pagi. In *EDISI: Jurnal Edukasi dan Sains* (Vol. 3, Issue 2).
- Mahya, B. H., & Setiawan, D. (2024). Development of Carabisatulus chatbot learning media based on environment to improve science learning outcomes. *Jurnal Penelitian Pendidikan IPA*, 10(6), 3132–3140. <https://doi.org/10.29303/jppipa.v10i6.7185>
- Masykur, R. (2020). *Teori dan telaah pengembangan kurikulum*. <http://repository.radenintan.ac.id/id/eprint/9167>
- Maulidah, A. N., & Aslam, A. A. (2021). Penggunaan media puzzle secara daring terhadap hasil belajar IPA kelas V SD. *Mimbar Ilmu*, 26(2), 281. <https://doi.org/10.23887/mi.v26i2.37488>
- Mulyanto, S., & Mustadi, A. (2023). Media pembelajaran powerpoint interaktif pada mata pelajaran IPS kelas V sekolah dasar. *Jurnal Penelitian Dan Pengembangan Pendidikan*, 7(1), 110–116. <https://doi.org/10.23887/jpppp.v7i1.54552>
- Nur Auliah, F., Febriyanti, N., & Rustini, T. (2023). Analisis hambatan guru dalam penerapan model problem based learning pada pembelajaran IPS kelas IV di SDN 090 Cibiru Bandung. *Journal on Education*, 05(02), 2025–2033.

- Nur Saputra, D., Jumadi, Kholil, A., Faipri Selegi, S., Murjainah, M., Agus, Setia, A., Sinaga, K., & Farisi, A. (2021). *Landasan Pendidikan*.
- Nurdyansyah, N. (2019). *Media pembelajaran inovatif*.
- Nurdyansyah, N., Wahid, Y., Nuzulia, N., & Bahak Udin By Arifin, M. (2020). *Development of learning media for PENA (Puzzle Nusantara) material for cultural diversity to improve learning outcomes for class IV students at MIS Al-Falah Lemahabang*. 4(2).
- Nurwahidah, N., Samsuri, T., Mirawati, B., & Indriati, I. (2021). Meningkatkan keterampilan kolaborasi siswa menggunakan lembar kerja siswa berbasis saintifik. *Reflection Journal*, 1(2), 70–76. <https://doi.org/10.36312/rj.v1i2.556>
- Parinduri, W. M., Rambe, T. R., Kesumawati, D., & Franklin, T. N. D. (2022). The development of a digital module for natural sciences to improve islamic elementary school students' learning outcomes. *MUDARRISA: Jurnal Kajian Pendidikan Islam*, 14(2), 183–204. <https://doi.org/10.18326/mdr.v14i2.183-204>
- Pratama, S. A., & Intan, R. (2021). *Pengaruh penerapan standar operasional prosedur dan kompetensi terhadap produktivitas kerja karyawan divisi ekspor PT. Dua Kuda Indonesia*.
- Prayogi, S., Muhali, Samsuri, T., Hunaepi, Asy'ari, M., & Armansyah. (2014). *Model-model pembelajaran interaktif berpusatpada guru*.
- Priyatno, D. (2018). *Buku saku analisis statistik data SPSS*.
- Rahmi, M. S. M., Budiman, M. A., & Widyaningrum, A. (2019). Pengembangan media pembelajaran interaktif macromedia flash 8 pada pembelajaran tematik tema pengalamanku. *International Journal of Elementary Education*, 3(2), 178. <https://doi.org/10.23887/ijee.v3i2.18524>
- Riskyka, Lubis, R. R., & Yusnita, N. C. (2023). Development of media puzzle using game based learning approach to improve learning outcomes student mathematics in elementary school. *Journal of Elementary School Education*, 188–194. <https://doi.org/10.62966/joese.v1i3.338>
- Setiadi, Z. W., & Andriani, A. E. (2024). Development of interactive multimedia based on appy pie to improve learning outcomes of elementary school students. *Jurnal Penelitian Pendidikan IPA*, 10(7), 4048–4057. <https://doi.org/10.29303/jppipa.v10i7.8121>
- Setiawan, D., & Septiyani, V. (2023). Canva-based audio-visual media for the fourth grade elementary school Pancasila formulation process material. *Jurnal Edutech Undiksha*, 11(2), 251–260. <https://doi.org/10.23887/jeu.v11i2.62433>
- Simanungkalit, R., Sirait, J., & Thesalonika, E. (2023). Pengaruh penggunaan media video pembelajaran terhadap hasil belajar siswa kelas IV SD Negeri 097323 Dolok Hataran. *Journal on Education*, 6(1), 3379–3387. <https://doi.org/10.31004/joe.v6i1.3406>
- Sugiyono, S. (2016). *Metode penelitian pendidikan : Pendekatan kuantitatif, kualitatif, dan R&D*.
- Suparman, H. (2023). Paradigma pendidikan untuk meningkatkan SDM (Sumber daya manusia). *Jurnal Dinamika Pendidikan*, 16(3), 302–311. <https://doi.org/10.51212/jdp.v16i3.227>
- Wahab, A., Junaedi, J., & Azhar, Muh. (2021). Efektivitas pembelajaran statistika pendidikan menggunakan uji peningkatan N-Gain di PGMI. *Jurnal Basicedu*, 5(2), 1039–1045. <https://doi.org/10.31004/basicedu.v5i2.845>
- Wahidin, U. (2017). Interaksi komunikasi berbasis media pembelajaran dalam proses belajar-mengajar. *Edukasi Islami : Jurnal Pendidikan Islam*, 4(07), 197. <https://doi.org/10.30868/ei.v4i07.63>
- Wayan Kandia, I., Made Suarningsih, N., & Mayadiana Suwarma, D. (2023). The strategic role of learning media in optimizing student learning outcomes. In *Journal of Education Research* (Vol. 4, Issue 2). <https://jer.or.id/index.php/jer/article/view/193>
- Widyatmoko, H. (2019). The development of educational puzzle game based on the local wisdom using flash media to educate the students' characteristics of primary

- school. *Refleksi Edukatika : Jurnal Ilmiah Kependidikan*, 9(2). <https://doi.org/10.24176/re.v9i2.3293>
- Wiguna Chandra, A., Oktari, D., Salamah Siti, I., Eloisa De Angeline, J., & Prihantini. (2022). *Pentingnya keterampilan variasi mengajar guru dalam meningkatkan minat belajar siswa*.
- Wulandari, I. S., Agustini, F., & Rofian, R. (2023). Development of PARAWA (Javanese Literacy) learning media based on audio visual javanese language learning sandhangan swara material for class IV SD Negeri Sawah Besar 01 Semarang. *Wawasan Pendidikan*, 3(1), 299–308. <https://doi.org/10.26877/wp.v3i1.11554>
- Wulandari, S. A., & Ratnawati, N. (2024). Development of puzzle game learning media in social sciences subjects to improve student learning outcomes. *Jurnal Inovasi Teknologi Pendidikan*, 11(1). <http://dx.doi.org/10.21831/jitp.v11i1.61975>
- Yogica, R., Multtaqiin, A., Ardi, Lulfri, & Fitri, R. (2020). *Metodologi pembelajaran: Stratelgi, pendekatan, model, metode pembelajaran*.
- Yuliani, E., & Setiawan, D. (2024). Development of flipbook-based digital comics to improve learning outcomes on simple comic material. *Research and Development in Education (RaDEn)*, 4(1), 219–236. <https://doi.org/10.22219/raden.v4i1.32280>
- Zamhari, M., Hanif, A., & Ridzaniyanto, P. (2023). Development of TAPUBA puzzle as an independent learning medium for the periodic system of elements. *Jurnal Inovasi Pendidikan Kimia*, 17(1), 41–48. <https://doi.org/10.15294/jipk.v17i1.35560>
- Ziliwu, S., & Anas, N. (2024). The development of puzzle board card media to enhance students' critical thinking skills in science learning. *Jurnal Elementaria Edukasia*, 7(2), 2772–2785. <https://doi.org/10.31949/jee.v7i2.9612>