

ENHANCING SCIENCE LEARNING OUTCOMES THROUGH HUMAN RESPIRATORY ORGAN PUZZLE MEDIA AMONG FIFTH-GRADE STUDENTS AT SD NEGERI LAMREUNG, ACEH BESAR

Helminsyah^{*1}, Tria Marvida²

^{1,2} Elementary School Teacher Education Study Program, Bina Bangsa Getsempena University, Banda Aceh, Indonesia

* Corresponding Author: helmi@bbg.ac.id

ARTICLE INFO

Article history:

Received Nov 27, 2023

Revised Dec 13, 2023

Accepted Dec 27, 2023

Available online Dec 29, 2023

Keywords:

learning media, puzzle, learning outcomes, science, elementary school.

ABSTRACT

This study aims to determine the effect of using Human Respiratory Organ Puzzle Media on improving science learning outcomes of fifth-grade students at SD Negeri Lamreung, Aceh Besar. The media was designed to help students understand respiratory organ concepts through enjoyable and contextual interaction. This research employed a quantitative approach with a quasi-experimental Pretest-Posttest Control Group Design, involving 40 students (20 control, 20 experimental). Data were collected through learning outcome tests and student response questionnaires, analyzed using t-tests. Validity test results showed all items were valid ($r\text{-count} > r\text{-table}$) and the instruments were reliable (Cronbach's Alpha > 0.60). Normality tests showed data were normally distributed (Sig. > 0.05). Paired Sample t-test results showed a significant difference between experimental and control classes with Sig. (2-tailed) = $0.000 < 0.05$ and $t = -15.515$. These findings indicate that the Human Respiratory Organ Puzzle Media significantly improves learning outcomes, motivation, cooperation, and active engagement of students in elementary school science learning.

This is an open access article under the [CC BY-NC](#) license.

Copyright © 2023 by Author. Published by Bina Bangsa University Gethsemane



INTRODUCTION

Science education at the elementary school level plays an important role in building the foundation of students' knowledge and critical thinking skills. However, various challenges persist, such as limited facilities, lack of varied learning media, and low student interest and understanding of science material. Research shows that one of the biggest obstacles in elementary science learning is the lack of engaging learning media, which impacts students' low interest and learning outcomes (Syahputra et al., 2022).

Instructional media play an important role in helping teachers explain complex concepts in a more engaging and meaningful way. Appropriate media can increase students' attention, motivation, and understanding (Yu et al., 2022). Therefore, teachers

need to select media suited to elementary students' characteristics such as playing, moving, and hands-on learning (Ansari & Khan, 2020). This medium is an effective visual tool for developing logical thinking, concentration, and motor coordination skills (Ansari & Khan, 2020). Through puzzle activities, students learn to solve problems, cooperate, and hone social-emotional skills (Marfilinda & Akhiyar, 2024).

Based on preliminary observations at SD Negeri Lamreung, Aceh Besar, it was found that in science learning, particularly on the topic of human respiratory organs, teachers still used lecture and question-answer methods without visual aids. This caused most students to struggle in understanding respiratory organ concepts comprehensively. Interview results with the class teacher showed that approximately 60% of students scored below the Minimum Mastery Criteria (KKM) for this material. Furthermore, the teacher acknowledged that students were less capable of working cooperatively in groups and often behaved passively when given collaborative tasks.

These conditions indicate the need for innovative learning media that are engaging, interactive, and aligned with the characteristics of elementary school-aged children who enjoy playing and learning through direct experience. Puzzles are visual media capable of developing logical thinking skills, concentration, and children's motor coordination (Muslimin et al., 2025). By assembling puzzles, students learn to solve problems, cooperate, and interact with peers, making learning more active and enjoyable (Weng, 2022).

Puzzle-based media can increase student engagement, motivation, and understanding of science material. Human respiratory organ puzzle media, for example, can help students visualize and manipulate parts of the respiratory organs directly, making the learning process more enjoyable and meaningful (Astuti et al., 2025).

Previous studies have demonstrated that puzzle media can improve student learning outcomes. (Khasanah, 2019) found that puzzle media positively influenced Fiqh learning outcomes, while (Raswandi, 2023) proved that puzzles effectively improved understanding of fraction concepts in mathematics. However, these studies generally only highlighted cognitive aspects and have not extensively examined the influence of puzzles on students' social skills and cooperation in science learning.

This study addresses this gap by examining in depth the influence of puzzle media on improving science learning outcomes as well as cooperation skills and mutual respect among fifth-grade students at SD Negeri Lamreung, Aceh Besar. The novelty of this research lies in integrating educational game media with group-based cooperative learning,

thereby developing not only cognitive aspects but also students' affective and social dimensions.

Thus, this research is expected to contribute to science learning innovation in elementary schools through contextual, collaborative, and engaging puzzle-based learning. Therefore, the development and application of human respiratory organ puzzle media is highly relevant for improving fifth-grade students' science learning outcomes at SD Negeri Lamreung, Aceh Besar

RESEARCH METHODS

Study This use approach quantitative with method experiment quasi -experimental design. Approach This used Because researchers want to know influence the use of puzzle learning media towards improvement results Study student as well as ability Work The same in science learning . According to (Creswell & Creswell, 2017) study quantitative aim For test theory through measurement variables study in a way numerical and perform analysis statistics to determine connection or influence intervariable .

The research design used is a Pretest- Posttest Control Group Design, which involves two groups that is group experiments and groups control . According to (Quantitative, 2016) , design This give chance to researchers For compare condition beginning and end between second group to see effect from treatment given . Group experiment given treatment in the form of use of respiratory organ puzzle learning media humans , whereas group control Study use method conventional without media.

Design scheme study can seen in the table following :

Table 1. Pretest- Posttest Control Group Scheme

Group	Pretest	Treatment	Posttest
R	O_1	X	O_3
R	O_2	-	O_4

Information

R: Random

X: Treatment

- : Without treatment / class conventional

O_1 :Group pretest experiment

O_2 :Group pretest control

O_3 : Posttest group experiment

O_4 : Posttest group control

The population in this study consisted of all fifth-grade students at SD Negeri Lamreung, Aceh Besar in the 2024/2025 academic year, totaling 61 students comprising 31

students from class VA and 30 students from class VB. According to (Quantitative, 2016), a population is a generalization area consisting of objects or subjects with specific qualities and characteristics determined by researchers to be studied and concluded upon.

The sampling technique used random sampling, considering that the entire population had equal opportunity to be selected as research samples. The research sample consisted of two classes:

- Class VA as the control class (20 students) who learned using conventional methods without puzzle media.
- Class VB as the experimental class (20 students) who received treatment using Human Respiratory Organ Puzzle Media.

The instruments used in this study consisted of two types: learning outcome tests (pretest and posttest) and student response questionnaires.

1. Learning Outcome Test

This test was used to measure the improvement of students' cognitive learning outcomes on human respiratory organ material in the form of multiple-choice questions with indicators compiled based on learning objectives and the revised Bloom's taxonomy (Bloom, 2010). The test was administered before (pretest) and after treatment (posttest).

2. Questionnaire Response Student

The questionnaire was used to measure students' social skills and cooperation in the learning process using puzzle media. The measurement scale used a 5-point Likert Scale, ranging from strongly disagree to strongly agree (Cohen et al., 2002). Indicators in the questionnaire included task-sharing ability, appreciating opinions, managing conflict, mutual respect, and effective cooperation. Each instrument was first tested for validity and reliability. The validity test used Pearson Product Moment correlation, while reliability was tested using Cronbach's Alpha coefficient, with values ≥ 0.70 considered reliable (Hair, 2014).

Table 2. Instrument Specification Matrix

No	Learning objectives	Question Indicator	Cognitive Level	Statement
1	Know various respiratory organs man .	• Analyze function trachea in breathing	C4	1. Function trachea in respiratory organ system man is distribute air from larynx to bronchus .
		• Analyze function bronchus in system breathing	C4	2. Distributing air to the lungs is role bronchus in system breathing .

No	Learning objectives	Question Indicator	Cognitive Level	Statement
2	Know how the breathing process works man .	Evaluate importance understanding the respiratory organs man	C6	3. Importance understanding the respiratory organs man is to be able to understand How body functioning .
		Analyze role diaphragm in the system breathing	C6	4. Filter air is function diaphragm in the breathing process .
		Analyze the role of the respiratory organs in facilitate the breathing process	C6	5. the respiratory organs man in facilitate the breathing process is Work For facilitate gas exchange
		Analyze role nose in the breathing process .	C4	6. Function nose in the breathing process is produce oxygen .
		Analyze the inspiration and expiration processes .	C4	7. Contracts and the chest cavity expands is an inspiration process (stage breathing moment air enter into the lungs) diaphragm .
		Connecting the breathing process with need oxygen body .	C5	8. An efficient breathing process is very important For fulfil need oxygen body
		Designing Solutions for increase efficiency breathing .	C5	9. Get enough sleep and do n't exercising is one of the method For increase efficiency breathing
		Analyze internal gas exchange processes breathing .	C4	10. The process of gas exchange between lungs and blood occurs in the trachea
		Analyze connection between style life and respiratory health .	C4	11. Smoke can increase capacity lungs .
		Identifying factors that affect the health of the system breathing .	C4	12. Pollution air is factors that can increase risk disease breathing .
3	Know How method guard respiratory organ system to remain Healthy .	Designing a strategy for guard health system breathing .	C5	13. The best way For maintaining lung health is with method exercise regularly regular and avoid pollution air .
		Develop plan For increase health system breathing .	C5	14. Talking loudly is one of the things that can done For increase capacity lungs .

No	Learning objectives	Question Indicator	Cognitive Level	Statement
		Evaluate effectiveness method For guard health system breathing .	C6	15. Use of masks in prevent distribution disease breathing is the way that is not effective .
		Evaluate impact environment to health system breathing .	C6	16. Improvement risk disease lungs can caused by pollution air .
		Evaluate importance guard health system breathing .	C6	17. Guard health system breathing is very important For increase ability speak .
		Evaluate effectiveness vaccination in prevent disease breathing .	C6	18. Vaccination can help prevent disease breathing with method increase risk disease lungs .
		Analyze impact to habit smoke to health system breathing .	C4	19. Improvement risk disease one 's breathing the cause is habit smoking .
		Evaluate connection between activity physical and health system breathing .	C6	20. Activity physique can increase capacity lungs .
		Total amount		

As for the indicators and statements used in response participant educate can seen in the following table :

Table 3 . Indicator Questionnaire Response Learners

No	Indicator	Statement
1.	Ability share task	1. student can share task with Good in group moment using puzzle media. 2. student can identify the strengths and weaknesses of each member group For share task in a way effective .
2.	Ability value opinion .	3. student can listen and appreciate opinion Friend a group moment using puzzle media. 4. student can give bait constructive feedback to Friend a group moment using puzzle media
3.	Ability manage conflict	5. student can manage conflicts that arise in group with Good moment using puzzle media. 6. student can find a fair and satisfactory solution for all member group moment using puzzle media
4.	Mutual feeling value	7. student can show appreciation to friend's contribution a group moment using puzzle media. 8. student can give praise or award to Friend a group that has contribute Good moment using puzzle media .
5.	Effective cooperation	9. student can Work The same with effective in group For solve the puzzle. 10. student can reach objective group with Good moment using puzzle media.

Data analysis was performed use help device SPSS software version 26 with steps following :

1. Normality Test using the Shapiro–Wilk test for ensure normal data distribution .
2. Homogeneity Test using Levene's Test to ensure inter- data variance group homogeneous .
3. Paired Sample t-test for see difference results Study in group (pretest –posttest).
4. Independent Sample t-test for know difference between group experiments and controls .

In addition , the results questionnaire analyzed in a way descriptive quantitative For describe level Work same and response positive student to use of puzzle media in science learning .

2. RESULTS AND DISCUSSION

Results

Validity testing was used to evaluate the extent to which the measurement tool is reliable. A summary of the validity test results is presented in Table 4 (Sanaky, 2021) :

Table 4. Validity Test Results

No Questions	R- Count	R-Table	Information
Question 1	0.526	0.443	Valid
Question 2	0.478	0.443	Valid
Question 3	0.675	0.443	Valid
Question 4	0.550	0.443	Valid
Question 5	-0.044	0.443	Invalid
Question 6	0.455	0.443	Valid
Question 7	0.447	0.443	Valid
Question 8	0.490	0.443	Valid
Question 9	0.593	0.443	Valid
Question 10	0.459	0.443	Valid
Question 11	0.479	0.443	Valid
Question 12	0.512	0.443	Valid
Question 13	0.463	0.443	Valid
Question 14	0.488	0.443	Valid
Question 15	0.501	0.443	Valid
Question 16	0.488	0.443	Valid
Question 17	0.574	0.443	Valid
Question 18	0.461	0.443	Valid
Question 19	0.461	0.443	Valid
Question 20	0.076	0.443	Invalid

Based on Table 4, out of 20 statement items tested, two items did not meet the validity criteria, namely item number 5 and item number 20.

Reliability testing was conducted using Cronbach's Alpha formula. An instrument is considered reliable if Cronbach's Alpha ≥ 0.60 . The reliability test results are presented in the following table.

Table 5. Reliability Test Results

Cronach's Alpha	N of Items
.825	18

Based on the results in the table above, the Cronbach's Alpha value obtained was 0.825 with 18 statement items. This value indicates that the instrument has a high and consistent level of reliability, making it suitable for data collection.

A normality test was conducted to determine whether student learning outcome data were normally distributed. In this study, the normality test used Shapiro-Wilk because the sample size was less than 50 respondents. The normality test results are presented in Table 6.

Table 6. Normality Test Results

Class		Shapiro-Wilk		
		Statistics	df	Sig
Results	Pre-test Control	.947	20	.330
	Post-test Control	.931	20	.168
	Pre-test Experiment	.968	20	.704
	Post-test Experiment	.957	20	.485

Based on the statistical analysis in the table, the significance values (Sig.) in the Shapiro-Wilk test for each dataset were greater than 0.05. This indicates that the learning outcome data are normally distributed, so H_0 is not rejected. Thus, the data meet the normality assumption and can be used for further parametric statistical analysis.

A homogeneity test was conducted to determine whether the variance between the experimental and control groups was equal. If the significance value exceeds 0.05, the groups are homogeneous; otherwise, they are not.

Homogeneity test results in study This presented in Table 7. below .

Table 7. Results of Homogeneity Test

		Levene Statistics	df1	df2	Sig
Lag Results	Based on Mean	1,906	3	75	.136
	Based on Median	1,675	3	75	.180
	Based on Median and with adjusted df	1,675	3	65,388	.181
	Ased on trimmed mean	1,966	3	75	.126

Based on the homogeneity test results in Table 7, the significance value Based on Mean for learning outcome variance was 0.136. Since Sig. $0.136 > 0.05$, it can be concluded that the posttest learning outcome data variance in the experimental and control classes is

homogeneous. Thus, both data groups meet the homogeneity assumption and can proceed to the difference test (t-test). Based on the research problem formulation and objectives, the hypotheses in this study can be formulated as follows:

H_0 : There is no significant difference between student learning outcomes before and after using Human Respiratory Organ Puzzle Media in science lessons for grade V at SD Negeri Lamreung, Aceh Besar.

H_a : There is a significant difference between student learning outcomes before and after using Human Respiratory Organ Puzzle Media in science lessons for grade V at SD Negeri Lamreung, Aceh Besar.

If the significance value is less than 0.05 (Sig. < 0.05), there is a significant difference between groups. Conversely, if Sig. > 0.05, no significant difference exists.

Power test result data difference (paired sample test) for class control and class experiment presented in Table 8 below .

Table 8. Class Differential Power Test Results Control and Experiment

Paired samples test control

		Mean	Std. Deviation	Std.Error Mean	95% Confidence Interval of the Difference		T	df	Sig.(2-tailed)
					Lower	Upper			
Pair 1	Pretest- Posttest	- 3.05000	11.91847	2.66505	-8.62802	2.52802	- 1.144	19	.267

Paired sample test experiment

		Mean	Std. Deviation	Std.Error Mean	95% Confidence Interval of the Difference		T	df	Sig.(2-tailed)
					Lower	Upper			
Pair 1	Pretest- Posttest	- 21,300	6,140	1,373	-24,173	-18,427	- 15,515	19	.000

Based on the Paired Sample Test results, it can be concluded that there is a significant difference between student learning outcomes in the control and experimental classes. The Sig. value in the control class was $0.267 > 0.05$, meaning there was no significant difference between pretest and posttest scores in the control class. Meanwhile, the Sig. value in the experimental class was $0.000 < 0.05$, indicating a significant difference between learning outcomes before and after treatment using Human Respiratory Organ Puzzle Media.

The Paired Sample t-test results showed $t = -15.515$ with Sig. $0.000 < 0.05$. Thus, H_0 is rejected and H_a is accepted, meaning that the use of puzzle media has a significant effect on improving student learning outcomes on human respiratory organ material.

To evaluate students' affective and social aspects, a student response questionnaire was used to measure the extent to which puzzle media can train cooperation skills and foster mutual respect during the learning process using a Likert Scale.

As for the results analysis questionnaire response participant educate to use of respiratory organ puzzle media man presented in Table 9 below .

Table 9. Questionnaire Results Response Learners

No	Statement	Average Score	Category
1	Student can share task with Good in group moment using puzzle media.	4.50	Very good
2	Student can listen and a ppreciate opinion Friend a group moment using puzzle media.	4.35	Good
3	Student can manage conflicts that arise in group with Good moment using puzzle media.	4.25	Good
4	Student can show appreciation to contribution Friend a group .	4.60	Very good
5	Student can Work The same in a way effective in group For finish task .	4.40	Good
6	Student can find fair solution in solve problem group .	4.30	Good
7	Student can give praise or award to Friend a group that has contribute Good .	4.55	Very good
8	Student can identify strengths and weaknesses member group For share task in a way effective .	4.20	Good
9	Student can reach objective group with Good moment using puzzle media.	4.45	Good
10	Student can show attitude each other appreciate and support during the learning process .	4.50	Very good
Overall Average		4.41	Very good

Description

1 = Strongly Disagree , 2 = Disagree , 3 = Neutral , 4 = Agree , 5 = Strongly Agree .

Based on Table 9, the overall average score was 4.41, which falls into the Very Good category. This result shows that the use of Human Respiratory Organ Puzzle Media received positive responses from students. Most students stated that puzzle media helped them in sharing group tasks, appreciating peers' opinions, and improving cooperation during the learning process. Students also felt more enthusiastic and active because learning became more interesting and interactive.

This result aligns with Febianti et al. (2022), who found that puzzle media increases learning motivation, activity, and cooperation among students, creating a more interactive classroom atmosphere. Similarly, Muslimin et al. (2025) found that puzzle-assisted problem-based learning significantly improved learning activity and problem-solving skills, while Biantong et al. (2023) showed that puzzle media enhanced motivation, learning outcomes, and collaborative skills in elementary students.

Discussion

1. The Influence of Puzzle Media on Learning Outcomes

The results showed a significant improvement in learning outcomes in the experimental class after using Human Respiratory Organ Puzzle Media. Theoretically, the effectiveness of puzzles can be explained through the constructivist approach. According to Piaget, learning occurs when students actively construct their knowledge through assimilation and accommodation based on concrete experiences (Samuels, 2024).

The use of puzzles allows students to build scientific concepts independently by connecting image pieces that represent the structure and function of respiratory organs. Such manipulative activities increase cognitive engagement and conceptual understanding because students actively create meaning from real learning experiences (Guan et al., 2024).

These results align with findings by (Nur Jannah, 2020), which showed that interactive multimedia significantly improved science learning outcomes through concept visualization. Similarly, puzzle media strengthens students' active engagement and facilitates the transition from concrete to abstract thinking in accordance with elementary school children's cognitive stages.

These results are also consistent with the meta-analysis by (Alotaibi, 2024), which concluded that game-based learning and puzzle-based learning positively impact learning outcomes and student motivation at the elementary education level. Through puzzles, students experience exploration-based learning that stimulates critical thinking and problem-solving abilities (Oktaviani & Elmojahed, 2023). Thus, the significant improvement in learning outcomes can be explained through cognitive mechanisms that support students' active knowledge construction.

2. Puzzle Media and Developing Student Collaboration

Beyond cognitive aspects, puzzle media also proved effective in improving cooperation skills and mutual respect among students. In group activities, puzzles require students to coordinate, negotiate, and share responsibility. This process reflects Vygotsky's social constructivism principles, where social interaction serves as an important means for cognitive and social development (Samuels, 2024).

Questionnaire results showed that students found it easier to cooperate, help each other, and appreciate peers' opinions when using puzzle media. These findings align with (Guan et al., 2024), who found that game-based learning in elementary schools can improve

social interaction and collaborative problem-solving skills. Thus, puzzles also function as a medium for developing social skills (Lubis & Yusnita, 2023).

Furthermore, puzzles help students manage emotions and develop empathy, as group activities require patience and cooperation to achieve shared goals (Alotaibi, 2024).

3. Implications for Science Learning in Elementary School

The results of this study provide important implications for science learning in elementary schools. First, puzzle media can serve as an active, constructivism-based learning strategy that helps students understand abstract concepts through visual representation and manipulative activities. Teachers can integrate puzzles into the science learning cycle from exploration to reflection (Samuels, 2024). International research shows that collaborative game-based learning strategies increase student engagement and self-efficacy toward science (Guan et al., 2024).

Third, this research confirms the need for developing teacher competence in designing simple game-based learning media. Teachers need training in linking puzzle use with science learning objectives, assessing both cognitive and social learning outcomes, and facilitating reflective discussions after activities (Alotaibi, 2024). As explained by (Nur Jannah, 2020), teachers need to utilize creative learning media to overcome learning fatigue. The use of puzzle media can be an innovative alternative aligned with the spirit of active and enjoyable learning in elementary schools.

Thus, puzzle media not only functions as a visual aid but also as an active learning tool capable of building 21st-century skills such as collaboration, communication, and critical thinking from elementary school age.

CONCLUSION

Based on the research results, it can be concluded that the use of Human Respiratory Organ Puzzle Media has a significant effect on improving student learning outcomes in science for grade V at SD Negeri Lamreung, Aceh Besar. The paired sample t-test results showed a significance value of $0.000 < 0.05$, indicating a significant difference in learning outcomes before and after treatment in the experimental class. Additionally, the questionnaire results showed an average score of 4.41 in the Very Good category, indicating positive student responses to learning using puzzle media. Overall, puzzle media is not only effective in improving students' conceptual understanding but also capable of developing cooperation skills, communication, and mutual respect among students. Thus,

puzzle media has proven to be an engaging, interactive, and meaningful alternative learning medium for elementary school students.

Based on these findings, teachers are recommended to utilize puzzle media as an active learning strategy for teaching abstract science concepts. Schools are expected to provide support in the form of training and facilities to encourage teachers to innovate. For future researchers, it is recommended to conduct studies with broader sample coverage, develop digital versions of puzzle media, and explore the long-term impact of puzzle media on knowledge retention and critical thinking skills of elementary school students.

REFERENCES

- Alotaibi, M.S. (2024). Game-based learning in early childhood education: A systematic review and meta-analysis. *Frontiers in Psychology* , 15 , 1307881. <https://www.frontiersin.org/articles/10.3389/fpsyg.2024.1307881/full>
- Ansari, JAN, & Khan, N.A. (2020). Exploring the role of social media in collaborative learning the new domain of learning. *Smart Learning Environments* , 7 (1), 9. <https://doi.org/10.1186/s40561-020-00118-7>
- Astuti, IA, Suhandi, A., Sopandi, W., Sujana, A., & Nurnaningrum, G. (2025). Analysis of Elementary School Students' Science Process Skills in the Merdeka Curriculum. *Journal of Science Education Research* , 11 (2), 837-844. <https://doi.org/10.29303/jppipa.v11i2.10147>
- Biantong, PT, Arsyad, N., & Suroyo, S. (2023). The Effect of Puzzle Media on Learning Motivation and Mathematics Learning Outcomes in Elementary School Students. *EduLine: Journal of Education and Learning Innovation* , 3 (2), 149-154. <https://doi.org/10.35877/454ri.eduline1509>
- Bloom, B. S. (2010). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives* . Longman.
- Cohen, L., Manion, L., & Morrison, K. (2002). *Research methods in education*. routledge. <https://www.taylorfrancis.com/books/mono/10.4324/9780203224342/research-methods-education-keith-morrison-louis-cohen-lawrence-manion>
<https://doi.org/10.4324/9781003150212>
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches* . Sage publications. [https://books.google.com/books?hl=en&lr=&id=335ZDwAAQBAJ&oi=fnd&pg=PT16&dq=Creswell,+J.+W.,+%26+Creswell,+J.+D.+\(2022\).+Research+design:+Qualitative,+quantitative,+and+mixed+methods+approaches+\(6th+ed.\).+SAGE+Publications.&ots=YEyRGJtvpN&sig=uzEwYnCsTW-DO0b5aQ8RYINvgg8](https://books.google.com/books?hl=en&lr=&id=335ZDwAAQBAJ&oi=fnd&pg=PT16&dq=Creswell,+J.+W.,+%26+Creswell,+J.+D.+(2022).+Research+design:+Qualitative,+quantitative,+and+mixed+methods+approaches+(6th+ed.).+SAGE+Publications.&ots=YEyRGJtvpN&sig=uzEwYnCsTW-DO0b5aQ8RYINvgg8)
- Dayanti, S., Alpusari, M., & Witri, G. (2023). Development of interactive learning media on human respiratory system learning material at Grade V elementary school. *DEVELOPMENT* , 12 (1). <https://doi.org/10.33578/jpfkip.v12i1.8974>
- Febianti, D., Azilla, MD, Syahrial, S., & Noviyanti, S. (2022). The Use of Puzzle Media in Motivating Learning of Grade III Students of SD Negeri 126/II Tanjung Agung. *AS-SABIQUN* , 4 (2), 395-405. <https://doi.org/10.36088/assabiqun.v4i2.1776>
- Guan, X., Sun, C., Hwang, G., Xue, K., & Wang, Z. (2024). Applying game-based learning in primary education: A systematic review of journal publications from 2010 to 2020.

- Interactive Learning Environments* , 32 (2), 534–556.
<https://doi.org/10.1080/10494820.2022.2091611>
- Hair, J.F. (2014). *A primer on partial least squares structural equation modeling (PLS-SEM)* . sage.
[https://books.google.com/books?hl=en&lr=&id=IFiarYXE1PoC&oi=fnd&pg=PR1&dq=Hair,+J.+F.,+Hult,+G.+T.+M.,+Ringle,+C.+M.,+%26+Sarstedt,+M.+\(2021\).+A+primer+on+partial+least+squares+structural+equation+modeling+\(PLS-SEM\)+\(3rd+ed.\).+SAGE+Publications.&ots=phNBxVZn_M&sig=gEHmZhgetTX6TelerXChLJfFb0](https://books.google.com/books?hl=en&lr=&id=IFiarYXE1PoC&oi=fnd&pg=PR1&dq=Hair,+J.+F.,+Hult,+G.+T.+M.,+Ringle,+C.+M.,+%26+Sarstedt,+M.+(2021).+A+primer+on+partial+least+squares+structural+equation+modeling+(PLS-SEM)+(3rd+ed.).+SAGE+Publications.&ots=phNBxVZn_M&sig=gEHmZhgetTX6TelerXChLJfFb0)
- Khasanah, U. (2019). *The Influence of Crossword Puzzle Strategy on Fiqh Learning Outcomes of Class VIII Students of Mts Ibnu Daud Karang Raja, South Lampung Regency* [PhD Thesis]. UIN Raden Intan Lampung.
- Quantitative, PP (2016). Qualitative and quantitative research methods and R&D. *Alfabeta, Bandung* .
https://www.researchgate.net/profile/Hery-Purnomo/publication/377469385_Metode_Penelitian_Kuantitatif_Kualitatif_Dan_Rd/Links/65a89006bf5b00662e196dde/Metode-Penelitian-Kuantitatif-Kualitatif-Dan-RD.Pdf
- Lubis, RR, & Yusnita, NC (2023). Development of Media Puzzle Using Game Based Learning Approach to Improve Learning Outcomes of Mathematics Students in Elementary School. *Journal of Elementary School Education* , 188–194.
- Marfilinda, R., & Akhiyar, M. (2024). *Literature Study on the Application of Puzzle Media in Learning in Elementary Schools*. *Indo-MathEdu Intellectuals Journal*, 5 (4), 4763–4776 .
<https://doi.org/10.54373/imeij.v5i4.1692>
- Muslimin, M., Krismanto, W., & Khaeriyah, U. (2025). The Effect of the Puzzle-Media-Assisted Problem-Based Learning Model on the Science Learning Activity of Class V Students. *Journal of Education and Computer Applications* , 2 (1), 86–92.
<https://doi.org/10.69693/jeca.v2i1.22>
- Nur Jannah, I. (2020). The Effectiveness of Using Multimedia in Science Learning in Elementary Schools. *Elementary School Scientific Journal* , 4 (1), 54.
<https://doi.org/10.23887/jisd.v4i1.24135>
- Oktaviani, A., & Elmojahed, A. (2023). The use of puzzle learning media to improve student learning outcomes in science subjects for class iv. *Techno-Pedagogy: Journal of Educational Technology* , 13 (2), 44–52.
<https://doi.org/10.22437/teknopedagogi.v13i2.38459>
- Pujasmara, DEPE (2024). Analysis of the Influence of Puzzle Games on the Development of Elementary School Students. *Educational Treasury* , 18 (2).
<https://doi.org/10.30595/jkp.v18i2.22419>
- Raswandi, NIM (2023). *Application of Fraction Puzzle Media In Improving Learning Outcomes Student Regarding Fraction Material Value in Class IV of Sd Negeri 23 Banda Aceh* [PhD Thesis, Bina Bangsa University Getsempena].
<https://eprints.bbg.ac.id/id/eprint/105/>
- Samuels, W.E. (2024). Classroom Constructivism Inventory: Informing Teaching Practices. *Journal of Curriculum and Teaching* , 13 (5), 405.
<https://doi.org/10.5430/jct.v13n5p405>
- Syahputra, A., Harahap, RD, & Safitri, I. (2022). An Analysis of Student Learning Challenges in Elementary School Science Subject. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kependidikan di Lapangan Pendidikan* , 8 (1), 237–247.
<https://doi.org/10.33394/jk.v8i1.4508>
- Weng, T.-S. (2022). Enhancing Problem-Solving Ability through a Puzzle-Type Logical Thinking Game. *Scientific Programming* , 2022 , 1–9.
<https://doi.org/10.1155/2022/7481798>

Yu, Z., Yu, L., Xu, Q., Xu, W., & Wu, P. (2022). Effects of mobile learning technologies and social media tools on student engagement and learning outcomes of English learning. *Technology, Pedagogy and Education* , 31 (3), 381–398.
<https://doi.org/10.1080/1475939x.2022.2045215>