



Effectiveness of Montessori-based Word Puzzle media on first-grade students' reading skills and motivation

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Abstract. Many first-grade students are struggling with reading and have very low motivation to learn. This study examined the effectiveness of Montessori-based word puzzle media on students' beginning reading skills and motivation to learn. The study used a quantitative quasi-experimental pretest-posttest control group design. The population consisted of first-grade students from ten elementary schools in Cluster I of Bogorejo District, Blora Regency. Using purposive sampling, the study selected two schools, involving 32 students (16 in the experimental group and 16 in the control group). Data were collected through beginning reading tests, learning motivation questionnaires, observations, and documentation, and analyzed using descriptive statistics and MANOVA. The experimental group achieved higher posttest mean scores in beginning reading skills (90.50) and learning motivation (89.31) than the control group (72.75 and 60.13, respectively). MANOVA indicated a significant simultaneous effect of Montessori-based

Word Puzzle Media (Pillai's Trace = 0.985; $F = 957.956$; $p < .001$). These findings suggest that the media effectively improves beginning reading skills and motivation to learn. Therefore, teachers are encouraged to integrate Montessori-based Word Puzzle Media into beginning reading instruction. By improving students' literacy skills and motivation to learn, future studies can use larger and more varied samples.

Introduction

Elementary school education is the main foundation of student competency development, especially reading literacy. Indonesia demonstrates this dedication through the Regulation of the Minister of Education, Culture, Research, and Technology (*Permendikbudristek*) Number 12 of 2024, which identifies literacy as an essential skill. Reading is foundational because it enables students to acquire and construct knowledge across all areas of the curriculum (Crawford et al., 2025). Nevertheless, initial data of first-grade students in Cluster I of Bogorejo District showed that only 22.6% could read well, while 41.6% were categorized as low readers, especially in letter recognition, phonics, and reading fluency. Classroom observations revealed that students showed low motivation for learning because teaching focused on the teacher, with almost no use of interactive learning media.

Early literacy is fundamental to reading comprehension and long-term academic success (Khosa, 2025; Nurmahanani, 2023; Iswara & Supriyadi, 2026; Indhra et al., 2025). The best way to teach beginners is through direct instruction in literacy skills, supported by fun, student-focused learning

activities. Motivating students to read not only leads to better reading skills but also increases their willingness to engage in literacy activities (Rettig & Schiefele (2023), whereas game-based interactive learning offers students the chance to practice often and get instant feedback to help improve their decoding and reading fluency skills (Yeratziotis et al., 2024). In the same vein, Montessori's way of teaching stressed on learning through multiple senses, giving students the freedom to learn, and allowing for self-correction, which are all elements that contribute to both literacy enhancement and the stimulation of learning motivation (David & Weinstein, 2024).

Developing literacy skills early in primary education is important because it lays the groundwork for one's academic journey (Purnadewi & Widana, 2023). In the initial grades, reading skills should be the main focus for students (Cameron et al., 2023; Wijaya et al., 2026). Research shows that recognizing letters, being aware of language sounds, knowing words, and understanding what one reads are highly correlated with later literacy success (Wackerle-Hollman et al., 2024). Research has shown that effective early literacy instruction and appropriate assessment practices are crucial for developing foundational reading skills and improving literacy outcomes (Gillon et al., 2020). Weak early decoding skills hinder literacy development and academic success, underscoring the importance of foundational reading instruction (Ehm et al., 2023). However, many elementary school students still struggle to master these skills. Preliminary observations of 137 first-grade students in Cluster I of Bogorejo District revealed that only 22.6% demonstrated good reading ability, while 41.6% had low reading skills. These findings indicate persistent difficulties in letter recognition, sound-symbol correspondence, and fluent reading of words and simple sentences.

Previous studies show that enjoyable, literacy-based learning activities can improve both reading skills and learning motivation, which are closely related to students' academic achievement (Yunita, N., & Ain, 2022; Widana et al., 2019). Therefore, innovative learning approaches and media are needed to create meaningful and engaging learning experiences for young learners. This is supported by the findings of Y.-S. G. Kim (2023) & Widana et al. (2023), who reported that learning approaches designed to improve students' reading skills can simultaneously enhance their learning motivation, indicating a close relationship between these two factors in supporting academic achievement. In addition, Sucena et al. (2023) found that literacy-based learning activities increase reading motivation and encourage students' active engagement in the learning process.

Furthermore, Montessori-based learning has been reported to facilitate active learning, promote independence, and increase students' motivation through hands-on activities and self-correction principles (Qizi & K., 2024). Research on literacy learning has generally emphasized improving students' reading achievement. For example, Psyridou et al. (2023) examined the effect of the Cooperative Integrated Reading and Composition (CIRC) model on elementary students' literacy skills, while Parsons & Erickson (2024) investigated the use of the read-aloud method to improve elementary students' reading skills and reading literacy.

Integrating Montessori-based word puzzle media with the Montessori method is expected to provide meaningful, child-centered learning experiences through concrete, manipulative activities (Syal & Nietfeld, 2024). Chen & Xiao (2024) reported that developing and using innovative learning media can significantly improve students' learning motivation and engagement in classroom activities. Based on these considerations, this study aims to analyze the effectiveness of Montessori-based word puzzle media on beginning reading skills and learning motivation of first-grade elementary school students.

Beginning Reading Skills

Beginning reading serves as the foundation for developing advanced reading abilities and plays an important role in supporting students' academic success (Schaughency et al., 2023). In addition,

Wolf et al. (2024) stated that reading literacy is a fundamental competency in elementary education and serves as a prerequisite for lifelong learning and academic achievement. Likewise, Tarjiah et al. (2023) emphasized that reading ability is a fundamental skill that contributes to students' academic achievement and learning development.

Learning Motivation

Learning motivation refers to the internal and external forces that drive students to engage in learning activities and achieve academic goals. Motivation plays a crucial role in determining students' learning success, as highly motivated learners tend to demonstrate persistence, curiosity, and active participation during instruction (Lei et al., 2024). Similarly, Ma & Chen (2024) reported that learning motivation is positively associated with emotional engagement and academic performance across ten aspects: persistence, resilience, concentration, curiosity, initiative, independence, goal orientation, self-confidence, participation, and reactions to rewards.

Montessori-Based Word Puzzle Media

Montessori-based word puzzle media are instructional materials consisting of letter pieces and pictures arranged to form meaningful words. Basuki et al. (2026) support this perspective. Interactive, game-based learning media can enhance students' motivation and learning by providing engaging, meaningful learning experiences. In fact, it is reasonable to assume that integrating Montessori principles with Word Puzzle Media will result in a hands-on, student-centered learning environment that fosters reading development and learning motivation.

Previous Studies

Several previous studies have reported that puzzle media can improve literacy skills among elementary school students. Couvee et al. (2024) found that word search puzzle activities integrated into picture storybooks enhanced students' vocabulary mastery and supported literacy development through engaging learning experiences. Similarly, Pugh et al. (2023) reported that the model significantly improved elementary students' literacy skills, while Apsari & Rizki (2018) demonstrated that the read-aloud method contributed positively to reading ability and literacy development. Consistent with this perspective, Apsari & Rizki (2018) revealed that interactive learning media facilitated active student participation and meaningful learning experiences through direct interaction with learning materials. Likewise, Septianing (2024) reported that game-based learning media increased students' interest and motivation by providing engaging and interactive learning experiences.

Given this research gap, this paper explores the extent to which Montessori-based Word Puzzle Media helps first graders develop initial reading skills and motivates them to learn. More precisely, this paper inquires about (1) whether Montessori-based Word Puzzle Media significantly contributes to developing students' beginning reading skills; (2) whether it significantly results in students' learning motivation; and (3) whether it simultaneously leads to both beginning reading skills and learning motivation. Correspondingly, the propositions of the study are: H1: Montessori-based Word Puzzle Media has a significant impact on students' beginning reading skills; H2: Montessori-based Word Puzzle Media has a significant impact on students' learning motivation; and H3: Montessori-based Word Puzzle Media has a significant simultaneous effect on both beginning reading skills and learning motivation.

Method

Type of research

The study used a quantitative approach with a quasi-experimental pretest-posttest control group design. Quasi-experimental research is widely used in educational settings to examine the

effectiveness of instructional innovations under natural classroom conditions (H. Kim & Clasing-Manquian, 2023). The investigation had one experimental group and one control group. The experimental group used Montessori-based word puzzle media, while the control group engaged in typical learning activities led by the classroom teacher. Both groups received pretests and posttests so the intervention's effects on beginning reading skills and motivation toward learning could be assessed. As illustrated in image 1, the research procedure consisted of participant selection, pretest administration, intervention, posttest administration, and data analysis.

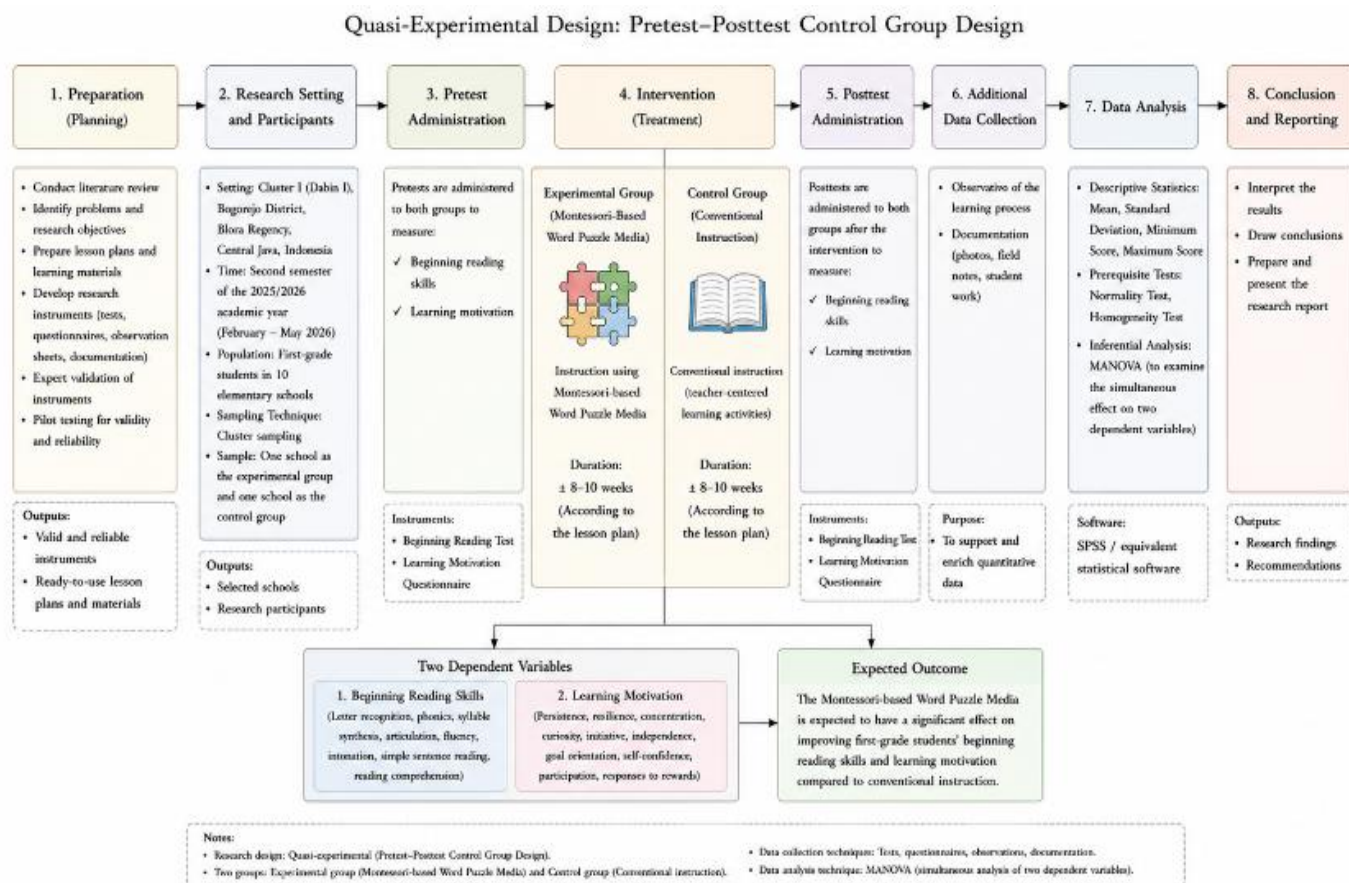


Image 1. Research Procedure Flowchart

Research Procedure

The study followed six consecutive steps to ensure systematic execution.

Phase 1: Preparation

The preparation stage began with an extensive review of available literature to identify the research issue and, afterward, develop a theoretical framework. Afterward, the researchers scheduled the research design, learning materials, and lesson plans for the control and experimental groups. In addition, the researchers prepared all research tools, including a test of beginning reading performance, a questionnaire to measure learning motivation, observation sheets, and documentation guidelines.

Phase 2: Instrument Validation and Pilot Testing

The researchers conducted a content validity check with experts before finalizing the instruments and collecting data. The validation tested indicators' relevance, content appropriateness, language clarity, and construct suitability. Based on the experts' recommendations, the researchers made

several changes to improve the quality of the instruments. Next, the researchers conducted a pilot test with students similar to the research sample to establish the instruments' validity and reliability.

Phase 3: Pretest Administration

Beginning reading skills were assessed using a performance test covering letter recognition, letter-sound correspondence, syllable blending, word reading accuracy, pronunciation, intonation, reading fluency, simple sentence reading, and reading comprehension. Learning motivation was measured using a questionnaire assessing persistence, resilience, concentration, curiosity, initiative, independence, goal orientation, self-confidence, and participation. Classroom observations monitored students' participation during the intervention.

Phase 4: Treatment Implementation

In the experimental group, students learned using Montessori-based Word Puzzle Media. The teacher introduced picture cards and modeled the pronunciation of letters, syllables, and words. Students then arranged letter or syllable puzzle pieces to form meaningful words individually or in groups, read them aloud, and checked their answers using the media's self-correction feature. The teacher provided guidance and feedback while encouraging active participation and independent learning. In contrast, the control group received conventional beginning reading instruction using textbooks and teacher-led activities without Montessori-based Word Puzzle Media.

Phase 5: Posttest Administration

Immediately after the intervention, both groups completed the same beginning reading performance test and the learning motivation questionnaire used in the pretest. The researchers also collected observation sheets and documentation to corroborate the quantitative results. The posttest results measured progress in beginning reading skills and learning motivation after introducing the media based on a Montessori-based Word Puzzle.

Phase 6: Data Analysis Technique

Performance tests, questionnaires, classroom observations, and documentation were the main data-collection tools. The performance test gauged students' beginning reading skills, while the questionnaire evaluated learning motivation. Observations noted students' engagement during Montessori-based Word Puzzle media learning activities, and documentation provided evidence. The data were first analyzed descriptively (mean, standard deviation, minimum, and maximum scores), and inferential statistics were also used. After that, the researchers conducted normality and homogeneity tests before hypothesis testing. The researchers then used MANOVA (Multivariate Analysis of Variance) to identify the joint effects of Montessori-based Word Puzzle media on students' beginning reading skills and learning motivation (Li, C.-H., Johnson, N., Marcello, M., Waisman, R., Cheng, Y., & Tze, 2021).

Time And Research Setting

The research was conducted in the second semester of the 2025/2026 academic year (February to May 2026) in public elementary schools under Cluster I (Dabin I) of Bogorejo District, Blora Regency, Central Java. The research targeted first-grade students, as beginning reading skills and learning motivation are basic competencies to develop during the first years of primary education. Students in the experimental group were taught using the Montessori-based Word Puzzle Media, while students in the control group received teacher-centered traditional instruction.

Research Subjects

The population comprised all first-grade students from ten public elementary schools in Cluster I (Dabin I), Bogorejo District, Blora Regency, Central Java, Indonesia. Purposive sampling selected two schools with comparable accreditation, curriculum implementation, learning facilities, and

initial reading abilities to ensure comparable experimental and control groups and minimize confounding variables. The sample consisted of 32 first-grade students aged 6–7 years: 16 students from SDN 1 Bogorejo (experimental group), who received instruction using Montessori-based Word Puzzle Media, and 16 students from SDN Prantaan (control group), who received conventional instruction.

Research Instrument

Four research instruments were used: (1) a beginning reading performance test, (2) a learning motivation questionnaire, (3) an observation sheet, and (4) documentation. The beginning reading test assessed letter recognition, letter–sound correspondence, syllable blending, word reading accuracy, pronunciation, intonation, reading fluency, simple sentence reading, and reading comprehension (Dorin et al., 2021). Learning motivation was measured using a questionnaire covering persistence, resilience, concentration, curiosity, initiative, independence, goal orientation, self-confidence, participation, and responses to rewards (Howard et al., 2021). Observation sheets recorded students’ participation and engagement, while documentation supported data verification. Before data collection, two experts (material and media experts) validated all instruments and the Montessori-based Word Puzzle Media using a 10-item Likert-scale instrument. The material and media experts awarded scores of 80.00% and 78.00%, respectively, indicating that the instruments and media were classified as Good with only minor revisions required. The instruments were subsequently pilot-tested, and reliability analysis using Cronbach’s Alpha yielded a coefficient of 0.949, indicating excellent internal consistency (Schweder & Raufelder, 2022). Therefore, the research instruments were considered valid, reliable, and suitable for use in the main study as summarised in Table 1.

Table 1. Expert Validation Results

Validator	Number of Items	Score Obtained	Maximum Score	Percentage	Category
Material Expert	10	40	50	80.00%	Good
Media Expert	10	39	50	78.00%	Good

To help readers understand how each research variable is measured, Table 2 summarizes the layout of the research instruments.

Table 2. Blueprint of Research Instruments

Variable	Data Collection Technique	Indicators	Item No.	Instrument
Beginning Reading Skills	Performance Test	Letter recognition, letter–sound correspondence, syllable blending, word reading accuracy, pronunciation, intonation, reading fluency, voice clarity, reading simple sentences, and reading comprehension	1–10	Performance-based reading test
Learning Motivation	Questionnaire	Persistence, resilience, concentration, curiosity, initiative, independence, goal orientation, self-confidence, participation, and response to rewards	1–20	Likert-scale questionnaire

Variable	Data Collection Technique	Indicators	Item No.	Instrument
Learning Activities	Observation	Participation, interaction, engagement, independence, and reading performance	1–5	Observation sheet
Supporting Data	Documentation	Lesson plans, worksheets, photographs, and field notes		Documentation checklist

Results and Discussion

Before hypothesis testing, we conducted normality and homogeneity tests to confirm that the assumptions for Multivariate Analysis of Variance (MANOVA) were met. The results indicated that the data met the assumptions of normality and homogeneity, as all significance values were above 0.05. These results indicated that the data set was suitable for further MANOVA analyses.

Normality Test

The normality test used the Kolmogorov-Smirnov test. Table 3 presents the results.

Table 3. Descriptive Statistics of Posttest Scores

Statistic	Experimental Group (n = 18)	Control Group (n = 18)
Mean	90.50	86.50
Standard Deviation (SD)	4.98	4.98
Minimum	82	78
Maximum	99	95
Skewness	0.000	0.000
Kurtosis	-0.947	-0.947

Descriptive statistics scores in the experimental group ranged from 82 to 99, whereas those in the control group ranged from 78 to 95. The skewness values (0.000) and kurtosis values (-0.947) for both groups indicated that the score distributions were approximately normal.

Homogeneity Test

We conducted the homogeneity test using Levene's Test of Equality of Error Variances. Table 4 shows the results.

Table 4. Homogeneity Test Results (Levene's Test)

Effect	Test Statistic	Value	F	Hypothesis df	Error df	Sig.	Decision
Class	Pillai's Trace	0.985	957.956	2	29	< 0.001	Significant

Based on Table 4, this result indicates that the variances of the experimental and control groups were homogeneous.

Table 5. Descriptive Statistics of Beginning Reading Skills and Learning Motivation

Variable	Levene Statistic	df1	df2	Sig.	Decision
Posttest	0.017	1	30	0.896	Homogeneous

Variable	Levene Statistic	df1	df2	Sig.	Decision
Posttest (Alternative Estimate)	0.000	1	30	1.000	Homogeneous

Beginning reading skills improved in both groups. The experimental group achieved a higher posttest mean score. These findings indicate that Montessori-based word puzzle media positively influenced both beginning reading skills and learning motivation.

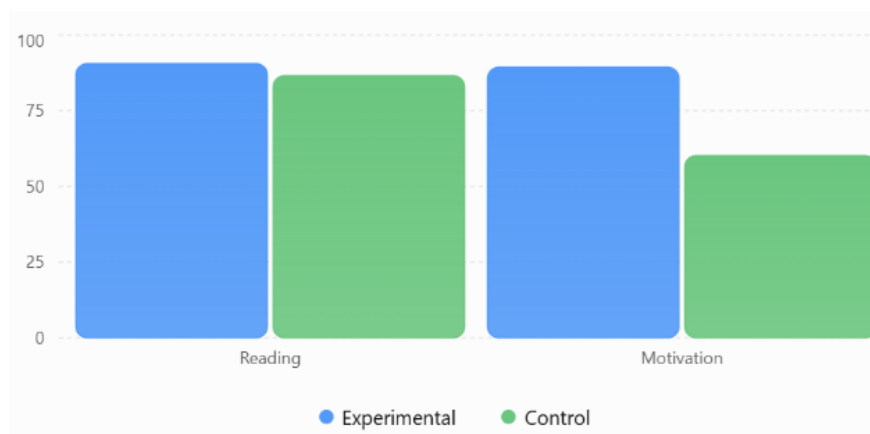


Image 2. Comparison of Posttest Scores Between Experimental and Control Groups

The image shows the mean posttest scores of beginning reading skills and learning motivation for students in the experimental and control groups.

Multivariate Analysis of Variance (MANOVA)

To investigate the simultaneous effect of Montessori-based word puzzle media on beginning reading skills and learning motivation, a MANOVA test was performed. Table 6 presents the results.

Table 6. Multivariate Test Results

Variable	Group	Mean	SD
Reading Pretest	Experimental	63.13	4.46
Reading Posttest	Experimental	90.50	4.98
Reading Pretest	Control	60.19	3.63
Reading Posttest	Control	72.75	3.16
Motivation Pretest	Experimental	62.69	3.92
Motivation Posttest	Experimental	89.31	3.09
Motivation Pretest	Control	58.13	2.71
Motivation Posttest	Control	60.13	2.20

Table 6 presents the results of Pillai's Trace statistic, which yielded a value of 0.985, with $F(2, 29) = 957.956$ and $p < 0.001$, indicating a statistically significant multivariate effect of the instructional treatment.

Tests of Between-Subjects Effects

To determine the treatment effect on each dependent variable separately, we conducted tests of between-subjects effects. Table 7 shows the results.

Table 7. Effects of Montessori-based Word Puzzle Media on Beginning Reading Skills and Learning Motivation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	417.133a	12	34.761	93.306	<.001	.985
Intercept	83968.443	1	83968.443	225388.979	<.001	1.000
Postes	417.133	12	34.761	93.306	<.001	.985
Error	6.333	17	.373			
Total	99726.000	30				
Corrected Total	423.467	29				

a. R Squared = .985 (Adjusted R Squared = .974)

Table 7 revealed that the treatment significantly affected both dependent variables. For beginning reading skills, the analysis yielded $F = 113.160$, $p < .001$. For learning motivation, the analysis showed $F = 156.129$, $p < .001$. These findings indicate that Montessori-based word puzzle media had a significant positive effect on students' beginning reading skills and learning motivation.

Discussion

Interpretation of Findings

Results from this study indicate that Montessori-based Word Puzzle Media significantly improved first-grade students' beginning reading skills and learning motivation compared with conventional instruction. These results align with other studies showing that Montessori and game-based learning methods improve reading performance and increase motivation to learn. Whereas earlier studies generally focused on either reading skills or learning motivation, our study examined both variables simultaneously using MANOVA. This method showed that Montessori-based Word Puzzle Media can enhance first graders' ability and motivation to learn. By manipulating letters, matching pictures with words, and practicing decoding, students enhanced their phonological awareness, word recognition, and reading fluency. These findings are supported by the descriptive statistics and MANOVA results, which showed significantly higher posttest scores for the experimental group than the control group.

Comparison with Previous Studies

Our results align with earlier studies showing that Montessori-based learning, as well as puzzle media, effectively improves young children's literacy skills and increases their motivation to learn. [Dayanti et al. \(2022\)](#) found that activities aligned with Montessori principles greatly improved beginning reading skills through concrete, active learning experiences. Similarly, [Glatz et al. \(2023\)](#) found that literacy games positively affected literacy growth. [Rosa & Suastra \(2023\)](#) and [Windar et al. \(2024\)](#) reported that interactive learning media increased student reading achievement and classroom engagement. [Hayati \(2023\)](#) and [Anggraini et al. \(2023\)](#) also found that puzzle media not only produced better learning outcomes but also increased student motivation by offering fun learning experiences.

This consistency between the current results and previous research indicates that students performed at a higher level in engagement and reading achievement when learning activities were

based on concrete experiences rather than conventional teacher-centered activities. [Sucena et al. \(2023\)](#); [Y.-S. G. Kim \(2023\)](#) and [Schaughency et al. \(2023\)](#) also reported similar results: early literacy development is supported by systematic decoding practice, phonological awareness, and meaningful learner interaction with instructional materials.

Differences from Previous Studies

The study examined both cognitive and affective outcomes using a quasi-experimental design and MANOVA analysis. Most previous research implemented puzzle-based learning without a clear focus on fully integrating these Montessori characteristics. This may explain why the improvement shown in this paper was stronger than in a few previous studies using conventional puzzle media only.

Research Novelty

The novelty of this research lies in merging Montessori principles and Word Puzzle media into one instructional method that concurrently develops the beginning reading skills and learning motivation of first-grade students. While most previous studies focused on cognitive or affective outcomes separately, this study shows that a Montessori-based Word Puzzle intervention can strengthen both domains within a single learning model. These results provide fresh empirical support for using Montessori-integrated Word Puzzle media as an all-round approach to early literacy education.

Relationship with Learning Theory

The findings align with constructivist learning theory, which states that learners create knowledge through meaningful interactions with learning resources. Through Montessori-based word puzzle media, first-grade elementary students physically engage with tangible learning materials, self-correct to get instant feedback, and repeatedly decode to reinforce phonological awareness. These experiences may explain the increases in reading skills and motivation for learning noted in this research. In addition, the results align with recent studies highlighting how active involvement, meaningful learning experiences, and learner independence are crucial for fostering literacy skills in children and motivating them to learn through their own interests ([David & Weinstein, 2024](#); [Ma & Chen, 2024](#)).

Theoretical Implications

In a broader theoretical framework, this study contributes to Montessori and constructivist theories by demonstrating that multisensory, self-directed, and concrete learning experiences improve both beginning reading skills and learning motivation. It shows that multisensory, self-directed, and concrete activities not only improve beginning reading skills but also enhance learning motivation. Besides supporting the effectiveness of Montessori methods in early literacy teaching, these results align with studies indicating that learning within a Montessori framework can be aligned with media-based literacy games. Therefore, this research extends the Montessori framework by supporting autonomy while also delivering cognitive outcomes through early reading and affective outcomes through learning motivation.

Practical Implications

This research gives a concrete example of the role creative, user-friendly, and inexpensive educational media can play in enhancing literacy in primary education. Montessori-based Word Puzzle media, given its simple, flexible, and cost-effective nature, can be skillfully blended into standard lessons, literacy interventions, and even remedial activities for pupils with reading problems at the initial stages, without requiring considerable extra resources. Thus, teachers gain a valuable teaching methodology that not only builds basic literacy skills but also nurtures students' motivation to learn, laying a foundation for academic progress over time.

Research limitations

The present study has some limitations. First, the sample consisted only of first-grade students in one elementary school cluster, which may limit how well the results generalize to the general population. Secondly, the intervention was carried out over a short period. Third, the study examined only beginning reading skills and learning motivation, while it did not consider other literacy-related outcomes, including reading comprehension, vocabulary acquisition, writing ability, or long-term retention.

Suggestions for Further Research

Additional research could examine the sustainability of the effects of Montessori-based Word Puzzle media over time, compare it with other literacy interventions, and investigate its influence on a broader set of literacy outcomes, such as reading comprehension, vocabulary acquisition, writing skills, critical thinking, and long-term learning retention. These studies would add to the empirical support for the effectiveness of Montessori-based literacy instruction in elementary education.

Conclusion

Montessori-based word puzzle media helped first graders develop their beginning reading skills and motivation to learn more than the traditional method. The treatment helped students better grasp letters, sounds, words, reading fluency, and text comprehension, and it also made them more active, confident, and cheerful about learning to read. These findings answer the research questions by confirming that integrating Montessori principles with Word Puzzle Media improves both beginning reading skills and learning motivation. Montessori-based Word Puzzle media pose an effective teaching option for initiating reading skills in elementary schools. Educators are advised to integrate this media into conventional literacy classes and remedial reading courses to create more interactive, student-centered, and meaningful learning experiences. Prospective scholars are advised to examine the long-term effectiveness of this teaching method using a larger, more varied population, as well as its effect on other literacy-related outcomes such as reading comprehension, vocabulary, writing skills, and critical thinking.

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