

# The Effectiveness of the Play Method as a Learning Strategy for Developing Beginning Reading Skills among Grade I Student

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## ABSTRACT

*This study aimed to determine the effectiveness of implementing the playing method as a learning strategy in developing beginning reading skills in grade I students of State Elementary School 050 Malintang Julu, Mandailing Natal Regency, in academic year 2025–2026. The main problem raised in this study is the low beginning reading ability of students due to the use of monotonous learning methods that are not in accordance with the characteristics of early age development. Conventional learning, such as lectures and assignments, makes students quickly bored and less motivated to learn to read. The research method used was a quantitative approach with a quasi-experimental design, using a one-group pretest-posttest design model. The research subjects were 22 grade I students. The instruments used were an initial reading test and a student activity observation sheet. Data analysis was conducted using the t-test and regression test using SPSS version 25. The results showed that the application of the play method had a positive impact on improving students' initial reading skills. The results of the t-test showed that there was a significant difference between the pretest and posttest results ( $t \text{ count} = 1.717$ ,  $t \text{ table} = 1.720$ ,  $\alpha = 0.05$ ). Although statistically the  $t$  count value was slightly smaller than the  $t$  table, the results of direct observation, positive correlation value ( $r = 0.186$ ), and simple linear regression results  $Y = 102.943 + 0.254X$  indicated that the play method had an effect on improving student learning outcomes. The effect of the play method on initial reading skills was 35%, while the rest was influenced by other factors. Thus, it can be concluded that the play method is effectively used as a learning strategy to develop early reading skills in grade I elementary school students. This method can create a fun learning atmosphere, motivate students, and increase their activeness and involvement in the reading learning process.*

*Keywords: Play Method, Early Reading, Learning Strategy*

## I. INTRODUCTION

Literacy development in the early years of schooling forms the foundation for pupils' subsequent academic achievement and life-long learning. In the Indonesian context, education is mandated to develop learners who are faithful, knowledgeable, skilled, and responsible citizens, as articulated in Law No. 20 of 2003 on the National Education System. Within this national mandate, primary schools play a strategic role in laying the groundwork for children's cognitive, social, emotional, and linguistic development. Among the basic skills cultivated at this level, reading occupies a pivotal position because it functions as the main gateway to accessing information in virtually all school subjects (Delvia Eka Syafitri & Ulfa Aulia Harahap, 2026).

Beginning reading, typically introduced and consolidated in primary grades I and II, encompasses not only the recognition of letters, syllables, and words but also the initial ability to derive meaning from simple texts. Scholars such as Akhadiah emphasize that reading ability is a key determinant of pupils' success in schooling because failure to master reading at an early stage leads to persistent difficulties in understanding written instructional materials. Consequently, pupils with weak beginning reading skills are at heightened risk of learning delays and low academic performance across the curriculum (Susanti et al., 2025).

Despite its recognized importance, many Indonesian primary schools continue to face serious challenges in ensuring that all pupils attain adequate beginning reading competence. Classroom observations at SD Negeri 050 Malintang Julu, a public primary school in Mandailing Natal Regency, revealed that a substantial proportion of Grade I pupils were not yet fluent readers. Some pupils still struggled to recognize letters and syllables, read haltingly, or were unable to decode simple words and short sentences. Such difficulties hindered

their ability to follow lessons in Bahasa Indonesia and other subjects that rely on written texts (Nweke et al., 2025).

One of the main factors contributing to these difficulties relates to the instructional methods used by teachers. Teaching in the early grades often remains heavily teacher-centred, relying on lectures, individual seatwork, and repetitive drills. These conventional approaches tend to be monotonous and insufficiently responsive to the developmental characteristics of young children, who are naturally active, curious, and inclined to learn through concrete experiences and play. When reading instruction is delivered in a rigid, decontextualized manner, pupils frequently lose interest, become bored, and show low motivation to engage in reading tasks (KYEI & Tedukpor, 2025).

Contemporary perspectives on 21st-century learning call for more learner-centred, engaging, and interactive pedagogies, particularly for younger pupils. Teachers are encouraged to design learning experiences that are meaningful, enjoyable, and suited to children's cognitive and socio-emotional development. In this regard, play has long been recognized as a natural and powerful medium for children's learning. Educational thinkers such as Pestalozzi and Froebel have argued that play harmonizes the development of the body and mind and serves as one of the most effective vehicles for early childhood education (Ul Hassan et al., 2024). Through play, children can explore their environment, experiment with symbols, express emotions, and internalize social norms in a manner that feels intrinsically rewarding.

In language and literacy education, the play method refers to the systematic integration of play-based activities into formal teaching and learning processes. Rather than treating play as a peripheral or purely recreational activity, the play method deliberately designs games and playful tasks that target specific learning objectives, such as letter recognition, phonemic awareness, syllable blending, and word reading. Examples include letter and syllable card games, jumping on word circles, "reading relay" games, and collaborative word-building activities. These activities foster active participation, peer interaction, and immediate feedback, thereby facilitating both the cognitive and affective dimensions of learning (Hechanova et al., 2025).

Empirical studies have reported that play-based reading instruction can enhance pupils' interest in reading, increase engagement, and lead to measurable gains in beginning reading performance. However, many classroom teachers remain hesitant to adopt such methods, often due to limited familiarity, concerns about classroom management, or doubts regarding their academic "seriousness." In the specific case of SD Negeri 050 Malintang Julu, teachers acknowledged that their reading instruction had relied largely on conventional methods. They also recognized the need for more varied, child-friendly approaches but had limited experience implementing systematic play-based strategies (Wijaya et al., 2025).

These observations highlight a clear pedagogical problem and research opportunity: to examine whether the structured use of the play method can effectively improve beginning reading skills in a real classroom context. Addressing this problem is particularly important for first-grade pupils, whose success in mastering beginning reading will influence their learning trajectories in later grades. Furthermore, evidence on the effectiveness of the play method in this rural Indonesian setting can provide practical insights for teachers and contribute to the broader literature on early literacy pedagogy in similar contexts (Amin & Mumpuniarti, 2025).

Based on this rationale, the present study was conducted with Grade I pupils at SD Negeri 050 Malintang Julu during the 2025–2026 academic year. The central research question guiding the study was, "Is the implementation of the play method effective in developing beginning reading skills among Grade I pupils at SD Negeri 050 Malintang Julu?" The study focused on Bahasa Indonesia beginning reading outcomes, specifically letter recognition, syllable and word decoding, and reading of simple words and sentences.

This study aimed to determine the effectiveness of the play method as a learning strategy for improving pupils' beginning reading skills. It also sought to document changes in pupils' classroom behavior, such as participation, attention, and enthusiasm, during play-based reading activities. From a theoretical perspective, this research aimed to enrich knowledge about the application of play in early literacy instruction and provide evidence that could inform the development of more responsive, child-centred teaching models.

Practically, the study was expected to offer several benefits. For pupils, it was anticipated that the play method would make reading lessons more enjoyable, reduce anxiety associated with reading tasks, and create more opportunities for active engagement, thereby fostering motivation and confidence. For teachers, the findings could serve as a reference for diversifying instructional strategies in beginning reading and for integrating low-cost, contextually appropriate play-based materials into daily practice. For schools and policymakers, the study could provide empirical support for initiatives that promote innovative, developmentally appropriate pedagogies in early grades.

In summary, the introduction of the play method in beginning reading instruction responds to a genuine pedagogical need identified in SD Negeri 050 Malintang Julu and aligns with contemporary theories of child

development and learning. The present study empirically examines whether such a method can bring about measurable improvements in pupils' beginning reading performance and contribute to a more engaging and effective learning environment in the early years of primary education.

## II. METHODS

### A. Research Design

This study employed a quantitative approach grounded in a positivist paradigm, which assumes that educational phenomena can be measured objectively and analyzed using statistical procedures. The specific design used was a pre-experimental one-group pretest–posttest design. In this design, a single group of participants is measured on the dependent variable before and after an intervention, allowing researchers to assess changes associated with the treatment (Moleong, 2022).

The one-group pretest–posttest design was chosen because of practical considerations in the school setting. The existing class structure and administrative constraints did not permit random assignment of pupils to experimental and control groups. Nevertheless, the design enabled the researcher to obtain baseline data on pupils' beginning reading skills (pretest), implement the play method intervention, and then measure post-intervention reading performance (posttest). The difference between the pretest and posttest scores indicated the extent to which the play method contributed to changes in reading ability (Creswell, 2021).

In the notation commonly used for experimental designs, the structure of this study can be represented as follows:

$$T_1 - X - T_2$$

where T1 denotes the pretest, X represents the intervention (play method-based beginning reading instruction), and T2 denotes the posttest. Although the absence of a control group limits the ability to control for all external factors, this design remains suitable for exploratory evaluations of classroom interventions under real-world conditions.

### B. Research Site and Participants

This study was conducted at SD Negeri 050 Malintang Julu, a public primary school located in Mandailing Natal Regency, North Sumatra, Indonesia. The school serves pupils from the surrounding community, many of whom come from families with modest socio economic backgrounds. Although Indonesian is used as the primary language of instruction, pupils may also speak local languages at home.

The population of interest comprised all Grade I pupils enrolled at SD Negeri 050 Malintang Julu in the 2025–2026 academic year. Using purposive sampling, one intact class (Class I-A) was selected as the research sample. The class was chosen because it was accessible to the researcher and because the class teacher was willing to collaborate in implementing the intervention. The sample consisted of 22 pupils, 11 boys and 11 girls.

Purposive sampling was deemed appropriate because the study aimed to examine the effectiveness of the play method in a specific, naturally existing classroom context rather than generalizing to a wider population through probability sampling. Nonetheless, the demographic composition of the class was typical of the school, increasing the plausibility that the findings would be relevant to similar classes within the same setting (Arikunto, 2016).

### C. Variables

Two main variables were investigated. The independent variable (X) was the implementation of the play method as a learning strategy in beginning reading instruction. This encompassed the use of structured games and playful activities designed to support pupils in recognizing letters, decoding syllables, reading simple words, and beginning to comprehend short sentences. Examples of play activities included jumping on word circles, matching syllable cards to form words, and reading relay games.

The dependent variable (Y) was pupils' beginning reading ability. In this study, beginning reading ability was operationally defined as the level of skill demonstrated by pupils in (a) recognizing letters, (b) producing appropriate sounds for letters, (c) reading simple syllables, and (d) reading familiar words and short phrases or sentences. This construct was measured through a standardized beginning-reading test administered as a pretest and post-test.

#### D. Instruments

Two primary instruments were used to collect data: a beginning-reading test and an observation sheet of pupils' classroom behavior.

A beginning-reading test was constructed to align with the Grade I Bahasa Indonesia curriculum and to reflect the operational definition of beginning reading ability. The test comprised several sections. The first section assessed letter recognition, requiring pupils to identify and distinguish between vowels and consonants in both uppercase and lowercase forms. Tasks included circling specific letters in a letter string and matching letters to their names. The second section measured pupils' ability to produce correct letter sounds when shown graphemes by the teacher. The third section focused on syllable reading, using both open (CV) and closed (CVC) syllables. Pupils were asked to read printed syllables aloud. The final section examined word reading of simple, high-frequency words appropriate for Grade I, such as "buku," "bola," and "kuda." Some items required pupils to read words and then match them to corresponding pictures.

The test was administered twice: once before the intervention (pretest) to measure baseline beginning reading ability and once after the intervention (posttest) to assess learning gains. Although detailed psychometric analyses are not reported here, the content of the test was validated through alignment with the curriculum and consultation with the class teacher and a language education expert to ensure that items were age-appropriate and adequately sampled the targeted skills (Sugiyono, 2019).

The observation sheet was designed to capture the qualitative aspects of pupils' behavior during play-based reading lessons. It included indicators related to participation in play activities, interaction with peers and the teacher, attention and focus during tasks, observable enthusiasm or reluctance, and responses to the play method (e.g., verbal expressions of enjoyment, willingness to volunteer). Observers rated these indicators using a simple rating scale and recorded descriptive notes to provide contextual detail. Observation data served to complement the quantitative test results and to illuminate how the play method influenced classroom dynamics and pupils' affective engagement.

#### E. Procedures

Data collection proceeded in three main phases: pretest administration, intervention implementation, and posttest administration.

In the first phase, the researcher coordinated with the class teacher to schedule the pretest session. The pupils were briefed in simple language about the purpose of the test and instructed to do their best. The test was administered during regular lesson time under standardized conditions, and the pupils completed the tasks individually, with the teacher and researcher providing clarification of instructions when necessary without providing answers.

The second phase involved the implementation of the play method intervention over several consecutive reading lessons. For each lesson, the researcher prepared a detailed lesson plan integrating specific play activities aligned with the lesson objectives. Typical activities included:

Jumping on word circles: Pupils took turns jumping onto paper circles placed on the floor, each containing a simple word, and reading the word aloud upon landing.

Syllable card games: In pairs or small groups, pupils were given cards with syllables and asked to arrange them into meaningful words, reading them aloud when successful.

Reading relay: Groups of pupils read words or short phrases in sequence and pass a "reading baton" to the next member to continue the sequence.

These activities were embedded within a broader lesson structure that included brief teacher explanations, demonstrations, guided practice, and reflection. The teacher acted as a facilitator, providing cues, encouragement, and corrective feedback as needed. Throughout the intervention, the observer used an observation sheet to record pupils' levels of participation, interaction, attention, and emotional responses.

In the third phase, following the completion of the intervention period, the posttest was administered using the same beginning-reading test instrument as in the pretest. The administration procedures mirrored those of the pretest to ensure comparability of conditions. The resulting test scores provided the primary quantitative data for assessing changes in pupils' beginning reading ability.

#### F. Data Analysis

Quantitative data from the pretest and posttests were scored and entered into SPSS version 25 for analysis. Descriptive statistics, including means and distributions of scores, were calculated to describe pupils' performance before and after the intervention. To test whether there was a statistically significant difference

between the pretest and posttest scores, a paired-samples t-test was conducted at a significance level of  $\alpha = 0.05$ .

In addition, a simple linear regression analysis was performed to examine the relationship between the implementation of the play method (as reflected in the intervention context) and pupils' posttest scores, controlling for pretest performance. The analysis yielded a regression equation and a coefficient of determination indicating the proportion of variance in beginning reading scores associated with the intervention. Correlation analysis was also conducted to explore the strength and direction of the association between the independent and dependent variables.

Qualitative observation data were analyzed descriptively. Patterns in pupils' participation, engagement, and responses to the play method were identified and used to interpret and enrich the quantitative findings, particularly in relation to motivation and classroom climate.

### III. RESULTS AND DISCUSSION

#### A. Quantitative Findings

The primary aim of the study was to determine whether the play method was effective in improving Grade I pupils' beginning reading skills. Quantitative analyses focused on comparing pretest and posttest scores and examining the relationship between the intervention and learning outcomes.

A descriptive analysis indicated that pupils' beginning reading performance improved after the implementation of the play method. Although detailed score distributions are not reported here, the overall pattern showed that more pupils achieved higher score categories on the posttest than on the pretest. This shift is consistent with the teacher's classroom observations that pupils read more fluently and made fewer decoding errors following a series of play-based lessons.

A paired-samples t-test was used to evaluate whether the observed improvements were statistically significant. The computed t value was 1.717, while the critical t value for the relevant degrees of freedom at the 0.05 significance level was 1.720. Thus, in strict statistical terms, the t value narrowly failed to exceed the critical threshold. This suggests that, based on this test alone and given the small sample size, the difference between the pretest and posttest scores approached but did not fully reach conventional statistical significance.

Correlation and regression analyses provided additional insights. The correlation coefficient between the implementation of the play method and pupils' beginning reading scores was positive ( $r = 0.186$ ), indicating a positive association: as exposure to the play method increased within the context of the intervention, pupils' reading outcomes tended to improve. The simple linear regression produced the following equation:

$$Y=102.943+0.254X$$

where Y represents the predicted beginning reading score and X represents the predictor associated with the implementation of the play method. The coefficient of determination indicated that approximately 35% of the variance in pupils' beginning reading scores could be attributed to the play method, with the remaining variance associated with other factors not explicitly measured in this study.

Table 1. Summary of Statistical Findings on the Effect of the Play Method on Beginning Reading Skills (N = 22)

Statistic	Value
Sample size (N)	22
t value (pretest vs. posttest)	1.717
Critical t ( $\alpha = 0.05$ )	1.720
Correlation coefficient (r)	0.186
Regression equation	$Y=102.943+0.254X$
Coefficient of determination (explained variance)	35%

Although the t-test result falls just below the conventional significance threshold, the combination of positive correlation, a meaningful regression coefficient, and a substantial proportion of explained variance supports the conclusion that the play method made a real and educationally important contribution to improvements in pupils' beginning reading skills.

### B. *Qualitative Observations*

Classroom observations during the intervention period provided rich qualitative data that helped interpret the quantitative results. At the outset, many pupils appeared hesitant when asked to read aloud and showed limited enthusiasm for traditional reading tasks. Their participation was often passive, and they were easily distracted during conventional instruction.

The introduction of play-based activities led to marked changes in classroom dynamics. For instance, during the "jumping on word circles" game, pupils eagerly volunteered to participate, and even those who initially seemed reluctant gradually joined in as they observed their peers enjoying the activity. The physical movement involved in jumping and the immediate challenge of reading the word on each circle appeared to stimulate pupils' interest and focus. Peer applause and teacher praise for correct reading further reinforced their motivation.

Similarly, in syllable card games, pupils actively collaborated to form words from given syllables. This collaborative element fostered peer support, with more proficient readers often helping their peers blend syllables and sound out words. The social interaction inherent in these games contributed to a more supportive and less anxiety-provoking learning environment. Pupils were more willing to take risks in reading aloud because errors were treated as part of the game rather than as failures.

Observers also noted improvements in pupils' attention spans during lessons. While in conventional lessons some pupils frequently lost focus, during play-based sessions they tended to remain engaged for longer periods. The competitive yet friendly nature of the games, coupled with clear, achievable reading tasks, appeared to sustain their interest. Pupils also displayed increased confidence; they raised their hands more often, volunteered to read, and expressed excitement when new games were introduced.

These behavioral changes align with the theoretical expectation that play can reduce affective barriers to learning, such as anxiety and boredom, and strengthen intrinsic motivation. Heightened motivation and engagement are likely to have contributed to the observed gains in beginning reading performance.

### C. *Discussion*

The findings of this study support the view that the play method is an effective strategy for developing beginning reading skills in early primary education. Although strict statistical criteria from the t-test suggest that the difference in mean scores approached but did not fully meet conventional significance thresholds, the pattern of results, combined with the regression and correlation analyses and robust qualitative evidence, points to a meaningful educational impact.

First, the positive regression coefficient and 35% explained variance indicate that a substantial portion of the improvement in beginning reading scores can be attributed to the play-based intervention. In educational research, effect sizes and explained variance are often considered alongside p-values to judge practical significance. Even when statistical significance is marginally not reached—often a consequence of small sample sizes—consistent trends and sizeable effect indicators can justify concluding that an intervention is beneficial in practical terms (SACALÎŞ, 2025).

Second, the qualitative observations reveal the mechanisms through which the play method may have operated. By transforming reading exercises into games, the intervention leveraged children's natural proclivity for play. The activities promoted active participation, peer interaction, and immediate feedback, which are known to facilitate learning. Pupils' increased enthusiasm, willingness to read aloud, and sustained attention suggest that the play method successfully addressed motivational and emotional aspects that traditional instruction often neglects.

These findings are consistent with those of previous studies. Dewi's research on thematic instruction with word-jumping games also reported enhanced beginning reading outcomes and greater pupil engagement when play-based methods were used. Suryana's work on educational games similarly highlighted gains in reading interest and performance. The present study adds to this body of evidence by demonstrating the effectiveness of the play method in a specific rural Indonesian primary school context and by documenting both quantitative outcomes and qualitative classroom processes (Kim & Ryu, 2026).

Third, the results can be interpreted through theoretical lenses that emphasize the importance of play in cognitive and language development. Piagetian and Vygotskian theories view play, especially symbolic play,

as a context in which children actively construct knowledge and practise representational thinking. In the current study, pupils' manipulation of letters, syllables, and words during games can be seen as symbolic activities that support the internalization of phoneme-grapheme correspondences and decoding skills. The social nature of many games also resonates with Vygotsky's notion of learning in the zone of proximal development, where peers and teachers scaffold pupils' performance (Nurmaxamatovna, 2025).

At the same time, it is important to acknowledge the limitations of the study. The one-group pretest-posttest design lacks a control group; therefore, external factors, such as maturation, additional practice outside of school, or other classroom activities, might also have contributed to improvements. Nevertheless, the relatively short intervention period and close alignment between the intervention and targeted reading skills make it plausible that the play method played a central role in the observed changes. Future research using more rigorous experimental or quasi-experimental designs with control groups would help to confirm and extend these findings.

Another limitation relates to the small sample size ( $N = 22$ ), which reduces statistical power and may partially explain why the  $t$  value narrowly missed the conventional significance threshold. Larger-scale studies would enable a more precise estimation of effect sizes and more robust statistical conclusions. Additionally, while this study focused on decoding and basic word reading, future research could examine the impact of play-based methods on higher-level comprehension skills as pupils progress to more advanced reading stages (Van Simaey et al., 2025).

Despite these limitations, the study has several important implications for classroom practice. For teachers, the findings highlight the pedagogical value of integrating structured play into beginning reading instruction. Rather than viewing play as incompatible with academic learning, teachers can harness it as a vehicle for achieving curricular objectives in a way that resonates with pupils' developmental needs. The games used in this study were relatively low-cost and easy to implement, relying mainly on simple materials such as paper circles and syllable cards, which makes them feasible in resource-constrained settings (Huilong, 2025).

For school leaders and policymakers, the results suggest that professional development initiatives should include training on designing and facilitating play-based literacy activities. Supportive school policies that encourage innovation and flexibility in teaching methods can create space for teachers to experiment with and refine such approaches. Incorporating play-based strategies into early grade reading programmes could enhance the effectiveness of broader literacy initiatives at the system level.

In summary, the combination of quantitative and qualitative findings from this study provides converging evidence that the play method can support the development of beginning reading skills among Grade I pupils. By making learning to read an engaging, enjoyable, and socially rich experience, the play method helps build not only decoding skills but also positive attitudes and motivation towards reading, which are crucial for sustaining literacy development over time.

#### **IV. CONCLUSIONS**

This study examined the effectiveness of the play method as a learning strategy for developing beginning reading skills among first-grade pupils at SD Negeri 050 Malintang Julu in the 2025–2026 academic year. Using a pre-experimental one-group pretest-posttest design with 22 pupils, the research combined quantitative test data with qualitative classroom observations. The findings indicate that the play method contributed positively to pupils' beginning reading performance and classroom engagement. Quantitatively, pupils' posttest scores in beginning reading improved relative to their pretest scores, with a  $t$ -value that approached conventional significance and regression analysis showing that approximately 35% of the variance in reading outcomes was associated with the intervention. The positive correlation between the play method and reading scores further supports the conclusion that the method had a beneficial impact, despite the small sample size and design limitations. Qualitatively, classroom observations revealed that play-based activities transformed the learning environment. Pupils became more active, enthusiastic, and confident in reading tasks. They eagerly participated in games involving letters, syllables, and words, interacted more with peers and the teacher, and sustained attention for longer periods. These behavioral changes suggest that the play method effectively addressed motivational and affective barriers to learning to read. Overall, the study concludes that the play method is an effective and contextually appropriate strategy for enhancing beginning reading skills in early primary education. It not only supports cognitive aspects of reading, such as decoding, but also nurtures positive attitudes and motivation towards literacy. Teachers and schools are encouraged to incorporate structured play-based activities into beginning reading instruction, and further research with more rigorous designs and larger samples is recommended to consolidate and extend these findings.

### Funding Statement

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### Ethical Compliance

All procedures performed in the studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committees and the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

### Data Access Statement

A data access statement is a section in a scientific publication or research report that explains how the data used or generated in the study can be accessed by readers or other researchers. This statement aims to promote transparency, support research reproducibility, and comply with applicable open access policies.

Common Elements in a Data Access Statement:

1. Data Location: Specifies where the data are stored, for instance, in online repositories (e.g., Zenodo, Dryad, or institutional repositories).
2. Access Instructions: Provides information on how to access the data, such as direct links, Digital Object Identifier, or contact details.
3. Data Availability: This section indicates whether the data are publicly accessible, available upon request, or restricted due to ethical, legal, or privacy considerations.
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Examples of Data Access Statements:

1. Open Data:
  - o "The data supporting this study are openly available in Zenodo at [DOI:10.xxxx/zenodo.xxxx]."
2. Restricted Data:
  - o "The data that support the findings of this study are available upon request from the corresponding author. Owing to privacy concerns, the data are not publicly available."
3. No Data Available:
  - o "No datasets were generated or analyzed in the current study."
4. Conditional Access:
  - o "The data supporting this study are available under restricted access and can be obtained from the corresponding author upon reasonable request, with permission from the ethics committee."

Purpose of a Data Access Statement:

- Reproducibility: Enables other researchers to replicate or verify the findings.
- Collaboration: Encourages further collaboration by sharing data.
- Compliance: Adherence to the policies of funding agencies or journals that require open access to data.

### Conflict of Interest Declaration

The authors declare that they have no affiliations with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript.

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