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Effectiveness of a Guided Experimental Method for Increasing Learning Interest in Group B Children at Pertiwi Tluwuk Kindergarten

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Abstract

Interest in learning in early childhood classrooms can decline when instruction relies on passive routines and limited hands-on activity. This study examined whether a guided experimental activity could increase learning interest among Group B kindergarten children (5–6 years) at Pertiwi Tluwuk Kindergarten. Using a non-equivalent control-group quasi-experimental design (N = 45; experimental n = 22, control n = 23), the experimental group participated in a low-cost science activity ("bubble fizzy"), while the control group received conventional instruction. Learning interest was measured before and after the intervention through a structured oral assessment administered consistently across groups. Post-test scores were substantially higher in the experimental group (M = 19.45, SD = 2.92) than in the control group (M = 9.96, SD = 3.32), with a mean difference of 9.50 points, 95% CI [7.61, 11.38]. An independent-samples t test showed a significant group difference, t(43) = 10.16, p < .001, with a very large effect size (Hedges' g = 2.97). The study contributes to the global early childhood literature by showing that short, guided, hands-on experiments can strengthen learning interest in resource-constrained kindergarten settings. Practically, the findings imply that teachers can use brief inquiry-based activities that combine child agency, immediate feedback, and observable cause-effect sequences to increase classroom engagement. However, interpretation remains limited by non-random class assignment, single-site implementation, and reliance on one assessment format. Future studies should use larger multi-site samples, baseline-adjusted analyses, and multimethod measures to test the durability and transferability of the effect across diverse pedagogical, cultural, and institutional contexts.

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Introduction

Sustaining children's interest in learning is a central challenge in early childhood education because interest functions as a proximal condition for attention, participation, and persistence during classroom activities. For children in Group B (5–6 years), learning experiences that are developmentally appropriate and experientially meaningful are expected to support not only cognitive growth but also socio-emotional engagement, which is closely linked to children's willingness to participate in learning tasks (Nurazqia et al., 2023).

Empirically, learning interest in early childhood is frequently shaped by interacting factors across classroom and home contexts. In Indonesian settings, studies associate learning interest with learning outcomes, teacher facilitation, cognitive learning orientations, and parenting patterns, suggesting that low interest is rarely attributable to the child alone but to the broader learning ecology (Achru, 2019; Gustina, 2020; Mahmudah et al., 2022; Rahayu et al., 2021). From a learning-theory perspective, interest is strengthened when children experience coherent reinforcement, meaningful feedback, and emotionally safe interaction, which places instructional design at the centre of interest formation (Sutarto, 2017; Wahab & Rosnawati, 2021).

In this study, *interest in learning* is treated as an observable learning disposition reflected in children's attentional focus, expressed curiosity, and readiness to participate in teacher-guided activities. When learning is dominated by passive routines or repetitive seatwork, children's interest may decline because the activity structure provides limited opportunities for exploration and agency. Classroom observations at Pertiwi Tluwuk Kindergarten indicated recurrent indicators of low learning interest, including off-task behaviour (e.g., daydreaming, chatting), weak attention to teacher explanations, and boredom during lessons. These indicators suggest a mismatch between instructional method and the engagement needs of children at this age.

A practical factor that may intensify this mismatch is the heavy reliance on worksheets and minimally varied instructional routines. Worksheet-driven activities can restrict hands-on exploration and reduce the immediacy of feedback that children typically need to remain engaged. In addition, limited learning resources and media can constrain teachers' capacity to design interactive experiences, which may further reduce children's learning interest (Djamarah, 2011). The problem, therefore, is not merely behavioural; it is instructional and design-related: how to structure learning so that children remain attentive, involved, and motivated to participate.

One approach that is theoretically aligned with active participation is the experimental learning method, which positions children as direct actors who observe processes, test simple predictions, and make sense of outcomes through guided exploration. In early childhood contexts, experimentation does not imply laboratory complexity; rather, it emphasises concrete manipulation, observation, and discussion that can transform learning into an activity with visible consequences and immediate feedback. This method is expected to increase learning interest by providing novelty, challenge, and opportunities for active participation, all of which are recognised as conditions that can stimulate interest and engagement (Suyadi, 2014). At the procedural level, experimental learning can be implemented through inquiry-oriented steps such as questioning, problem formulation, simple hypothesis building, conducting experiments, collecting observations, and drawing conclusions (Purwita, 2015).

Recent preschool and kindergarten studies using comparison-group designs indicate that guided hands-on or inquiry-oriented science activities can increase children's motivation or liking for science and related engagement indicators (Golubović-Ilić & Ćirković-Miladinović, 2020; Patrick et al., 2009; Yılmaz et al., 2024), and can also strengthen inquiry-related behaviours in classroom settings (Dejonckheere et al., 2016). Across this literature, motivation or interest and engagement are commonly assessed through child-friendly interview formats and structured behavioural coding (Gerosa et al., 2022; Halliday et al., 2018; Patrick et al., 2009).

Although experimental learning is frequently recommended for early childhood classrooms, empirical evidence that isolates its effect on *learning interest* as an outcome, especially using a comparison-group design in authentic kindergarten settings, remains limited. Many classroom reports emphasise implementation descriptions, while fewer studies employ designs that can better approximate causal inference under real school constraints. Addressing this gap, the present study evaluates the effectiveness of an experimental method implemented through a science activity ("bubble fizzy") in increasing learning interest among Group B children at Pertiwi Tluwuk Kindergarten. Accordingly, this study aims to test whether children who receive learning through the experimental method demonstrate higher post-intervention learning interest than children taught through conventional methods. The study is guided by the following hypothesis: post-intervention learning interest will differ between children in the experimental group and those in the control group.

Methods

Research Design

This study employed a quantitative quasi-experimental design using a non-equivalent control group with pre-test and post-test measures. Two intact Group B classes served as the experimental and control groups, and group assignment was non-random.

Setting and participants

The study was conducted at Pertiwi Tluwuk Kindergarten. The study population comprised Group B children (5–6 years) with a total of 45 participants drawn from two existing classes. Based on class membership, 22 children were included in the experimental class and 23 children in the control class.

Intervention and control condition

The experimental group received instruction using an experimental learning method implemented through a science activity labelled "bubble fizzy." In this activity, children were guided to mix baking soda, citric acid, and dish soap to produce foaming bubbles driven by carbon dioxide gas; food colouring was added to create visible colour variations. The control group received conventional classroom instruction and did not receive the experimental-method activity.

Measure: learning interest

Children's interest in learning was assessed using structured oral pre-test and post-test interviews. Interview-based formats are commonly used with kindergarten-age children to capture perceived liking and motivation for science-related tasks when written self-report questionnaires are not developmentally suitable (Golubović-Ilić & Ćirković-Miladinović, 2020; Patrick et al., 2009). The same assessment format and instrument were used for both measurements, with higher scores indicating higher learning interest. Administration procedures were kept consistent across groups to reduce instrumentation and testing threats.

Procedure

Both groups completed the oral pre-test prior to the intervention. After the pre-test, the experimental class received the experimental-method activity ("bubble fizzy"), while the control class continued with conventional learning activities. Following the intervention, both groups completed the oral post-test to assess changes in learning interest.

Data analysis

Data were analysed in SPSS. Descriptive statistics (range, minimum, maximum, mean, standard deviation, and variance) were used to summarise learning interest scores. Assumption checks were conducted prior to hypothesis testing. Normality was examined using the Kolmogorov–Smirnov test, and homogeneity of variance was examined using Levene's test.

Hypothesis testing used an independent-samples *t* test to compare post-test learning interest scores between the experimental and control groups. Statistical decisions were based on $\alpha = .05$. The hypotheses were specified as follows:

- H_0: The mean post-test learning interest score in the experimental group is equal to the mean post-test learning interest score in the control group ($\mu\_E = \mu\_C$).
- H_1: The mean post-test learning interest score in the experimental group differs from the mean post-test learning interest score in the control group ($\mu\_E \neq \mu\_C$).

To address non-equivalence risks inherent in non-random group assignment, baseline conditions were documented using the pre-test descriptive results, and the same measurement procedures were applied across groups.

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Result

The experimental group showed a substantially higher level of learning interest after the intervention than the control group. This difference is evident in the post-test mean scores, the magnitude of pre–post change, and the precision of the between-group estimate.

Baseline levels and score dispersion at pre-test

At baseline, the two classes started from comparable levels of learning interest, as reflected in the pre-test distributions. Table 1 summarises the pre-test and post-test scores for both groups. At baseline, the experimental group ($n = 22$) recorded a mean pre-test score of $M = 7.73$ ($SD = 2.98$; range 5–15), while the control group ($n = 23$) recorded a mean pre-test score of $M = 8.04$ ($SD = 3.25$; range 3–15). In descriptive terms, both groups began at a similar level, with comparable variability (variances 8.87 vs. 10.59). Relative dispersion at baseline was also similar, as indicated by the coefficient of variation (SD/M) of approximately 0.39 in the experimental group and 0.40 in the control group.

To supplement the descriptive comparison, a baseline mean difference check based on the available summary statistics indicated a small and imprecise difference between groups at pre-test (mean difference = −0.31, Welch $t(42.92) = -0.33$, $p = .740$, 95% CI [−2.18, 1.56]). The standardised baseline difference was negligible (Hedges' $g \approx -0.10$). Taken together, the baseline pattern suggests no meaningful separation in learning interest scores prior to the intervention, although the non-random assignment of intact classes means that unmeasured differences may still exist.

Post-test score patterns and visual comparison

After the intervention, the experimental group recorded a mean post-test learning interest score of $M = 19.45$ ($SD = 2.92$; range 13–22), whereas the control group recorded a mean post-test score of $M = 9.96$ ($SD = 3.32$; range 5–16). This indicates a large post-test separation in central tendency. The post-test ranges also show limited overlap: the experimental group's lowest observed score (13) fell within the upper portion of the control group's range (up to 16), suggesting that most experimental-group scores were above most control-group scores.

Beyond central tendency, the dispersion pattern is also informative. In absolute terms, post-test variability remained comparable across groups ($SD \approx 2.92$ vs. 3.32), but relative dispersion differed: the experimental group showed substantially lower relative variability (CV ≈ 0.15) than the control group (CV ≈ 0.33). This pattern is consistent with a concentration of higher scores in the experimental group at post-test.

Table 1. Learning interest scores by group (pre-test and post-test)

Measure	*n*	Range	Min	Max	*M*	*SD*	Variance
Pre-test (Experimental)	22	10	5	15	7.73	2.98	8.87
Post-test (Experimental)	22	9	13	22	19.45	2.92	8.55
Pre-test (Control)	23	12	3	15	8.04	3.25	10.59
Post-test (Control)	23	11	5	16	9.96	3.32	11.04

To complement the tabular summary, Figure 1 visualises the mean scores by group and time point, clarifying both the direction and the magnitude of change across the two groups.

As shown in Figure 1, the experimental group increased markedly from pre-test to post-test, whereas the control group showed only a modest increase.

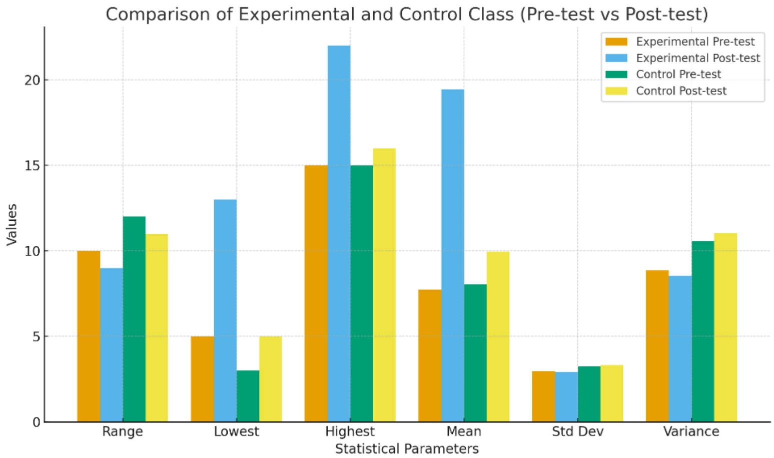

Figure 1. Mean learning interest scores at pre-test and post-test for the experimental ($n = 22$) and control ($n = 23$) groups.

Descriptive change from pre-test to post-test

A pre–post descriptive change comparison provides additional evidence about the direction of movement within each group. The experimental group increased from $M = 7.73$ to $M = 19.45$, an observed gain of 11.72 points. In contrast, the control group increased from $M = 8.04$ to $M = 9.96$, an observed gain of 1.92 points. The difference in mean gains between groups was therefore 9.80 points. Although a formal test of gain-score differences requires gain-score variability (not reported in Table 1), the gain pattern aligns with the post-test separation and indicates that the groups diverged in the expected direction following the intervention.

Assumption checks for parametric comparison

Prior to the between-group comparison, distributional assumptions were examined. Normality was tested using the Kolmogorov–Smirnov test, and the output includes both asymptotic significance values and Monte Carlo significance values. In small samples, Monte Carlo significance is often used as a decision basis when the asymptotic approximation is unstable. In this dataset, Monte Carlo p values indicated no evidence of non-normality at the .05 level for all four score distributions (pre-test experimental $p = .166$, post-test experimental $p = .095$, pre-test control $p = .330$, post-test control $p = .825$).

Table 2. Normality test results (Kolmogorov–Smirnov; Monte Carlo p)

Distribution	***n***	***D***	**Monte Carlo *p***
Pre-test (Experimental)	22	0.233	.166
Post-test (Experimental)	22	0.256	.095
Pre-test (Control)	23	0.191	.330
Post-test (Control)	23	0.124	.825

Homogeneity of variance for post-test scores was examined using Levene's test. The result indicated homogeneous variances between groups (Levene's $p = .396$), supporting the equal-variance t test as the primary specification while still allowing a robustness comparison with the unequal-variance alternative.

Table 3. Homogeneity of variance (Levene's test; post-test scores)

F	df1	df2	*p*
0.74	1	43	.396

Between-group post-test comparison and precision of the effect estimate

The primary inferential comparison used an independent-samples t test on post-test learning interest scores. Under the equal-variance assumption, the experimental group scored higher than the control group, $t(43) = 10.16$, $p < .001$ (two-tailed). The mean difference was 9.50 points, and the 95% confidence interval for this difference was [7.61, 11.38], indicating that the

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estimated post-test advantage for the experimental group remained large even at the lower bound of the interval.

A robustness comparison using the unequal-variance specification (Welch correction) yielded a nearly identical conclusion ($t(42.71) = 10.19$, $p < .001$), with a similar confidence interval. Thus, the statistical inference does not depend materially on the variance assumption.

Table 4. Independent-samples t test (post-test scores)

Specification	*t*	df	*p* (two-tailed)	Mean difference	*SE*	95% *CI* LL	95% *CI* UL
Equal variances assumed	10.16	43	< .001	9.50	0.94	7.61	11.38
Unequal variances (Welch)	10.19	42.71	< .001	9.50	0.93	7.62	11.38

In addition to statistical significance, the magnitude of the post-test difference was large in standardised terms. Based on the pooled post-test variability, the standardised mean difference corresponded to approximately three pooled standard deviations (Hedges' g = 2.97). This indicates a substantial separation between groups at post-test, consistent with the limited overlap suggested by the observed score ranges.

Experimental method yields higher post-test learning interest

Across descriptive and inferential layers, the results converge on the same pattern. The experimental group showed (i) a markedly higher post-test mean than the control group, (ii) a much larger pre–post gain in descriptive terms, and (iii) a precise and very large estimated post-test mean difference with a tight confidence interval.

Because the study used intact classes without random assignment, the finding is reported as evidence supporting the effectiveness of the experimental-method activity ("bubble fizzy") within the study context rather than as definitive proof of causality. Nevertheless, the combination of near-negligible baseline differences in observed pre-test means and the substantial post-test separation provides a coherent empirical basis for the main conclusion of this study.

Discussion

Post-test results show a substantial advantage for children who participated in the experimental-method activity compared with those who received conventional instruction. The estimated post-test mean difference of 9.50 points, together with the 95% *CI* [7.61, 11.38] and a very large standardised effect (Hedges' $g = 2.97$), indicates a practically meaningful shift in learning interest within this kindergarten setting. The descriptive pattern is internally consistent: baseline means were similar, the experimental group's pre–post change was large, and the control group's change was modest.

A plausible interpretation is that guided experimentation increases learning interest by changing the activity structure from passive reception to active participation. In early childhood classrooms, interest is often sustained when children receive immediate feedback from their actions and can observe clear cause–effect sequences. The "bubble fizzy" activity provides salient, multisensory cues, such as visible foam formation and colour variation, that can sustain attention and invite curiosity. This aligns with the view that interest develops when learning is experienced as meaningful, engaging, and responsive to children's actions (Nurazqia et al., 2023; Suyadi, 2014). Empirical work in early childhood science education similarly reports increases in children's science motivation following hands-on activities (Yılmaz et al., 2024) and higher perceived competence and liking when inquiry is integrated with literacy in kindergarten classrooms (Patrick et al., 2009).

The procedural structure of experimentation further strengthens this interpretation. When children are guided to ask simple questions, make predictions, observe changes, and share explanations, they are not only manipulating materials but also organising experience into understanding (Purwita, 2015). This combination of action and reflection can support perceived competence and agency, which may increase willingness to participate and persist. The lower relative dispersion observed in the experimental group at post-test is consistent with the possibility that the activity structure supported many children, not only a small subset, to demonstrate higher learning interest. Related classroom-based evidence suggests that inquiry-oriented programmes can increase informative exploration and experimentation behaviours among preschoolers relative to controls (Dejonckheere et al., 2016).

These findings are consistent with prior evidence that experimental learning can promote systematic inquiry and active involvement. Experimental methods have been described as encouraging learners to observe, investigate, and communicate findings, which supports curiosity and sustained engagement (Hamdani et al., 2019). Related studies also indicate that hands-on experimentation can improve learning processes and skills when learners are positioned to test and observe phenomena directly (Subekti & Ariswan, 2016). The present study extends this line of work by treating learning interest as the primary outcome in a kindergarten context and by estimating a clear between-group post-test difference.

Prior studies of experimental or hands-on science learning in early childhood generally report benefits for science-related outcomes, such as science ability, cognitive development, basic science process skills, conceptual understanding, and creativity (Artika, 2019; Azizah et al., 2021; Ma'viyah, 2021; Mustika & Nurwidaningsih, 2018; Salsabila, 2023; Susanti, 2023; Utami, 2017; Yahya, 2020). Work on early science content, including earth and space science, likewise emphasises exploration, observation, and child agency as design features that can sustain engagement (Iftitah & Anawaty, 2023). The present findings complement this evidence by specifying learning interest as the primary outcome and by estimating a precise post-test group difference under a comparison-group design.

At the same time, interpretation must remain disciplined because intact classes were used without random assignment. Selection effects cannot be fully ruled out, even when observed baseline differences in pre-test means are negligible. Teacher-level influences are also plausible contributors if instructional enthusiasm, pacing, or classroom management differed between classes. A novelty or Hawthorne-type effect may have elevated interest because the activity was unusual relative to typical routines. Measurement is another constraint: learning interest was assessed through structured oral tests, which may capture verbalised readiness to respond but may underrepresent behavioural engagement such as persistence and spontaneous exploration. Future research should treat learning interest as a multi-method construct rather than a single-score outcome. For example, structured observational systems for preschool learning engagement can complement interview-based measures and help separate verbal responsiveness from sustained on-task behaviour (Gerosa et al., 2022; Halliday et al., 2018).

Despite these constraints, the results provide actionable implications for classrooms facing low attention and boredom during learning activities. Teachers can design short experimental sequences that foreground child agency, where children manipulate materials, observe outcomes, and articulate what changed. These activities should be structured through a simple inquiry routine (question, prediction, action, observation, and explanation sharing) to keep learning child-centred while maintaining coherence (Purwita, 2015). Practical feasibility remains important because time, materials, and classroom readiness can constrain implementation (Siregar, 2019). The "bubble fizzy" activity illustrates a relatively low-cost option that can be conducted without laboratory facilities when procedures are standardised.

This study is limited by its single-site setting, small sample, intact-class design, and reliance on oral assessment. Longer interventions with repeated sessions and follow-up measurement are needed to examine whether increased interest is sustained beyond an initial activity. Future studies should incorporate analytic strategies that explicitly control baseline scores (e.g., ANCOVA) and triangulate learning interest using behavioural observation, teacher ratings, and child-friendly self-report formats when appropriate. Implementing multiple

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experimental activities across weeks would also help distinguish novelty effects from durable changes in learning disposition.

Conclusion

This study found that the experimental-method science activity ("bubble fizzy") was associated with higher learning interest than conventional instruction among 45 Group B children (5–6 years). The experimental group achieved a mean post-test score of $M = 19.45$ compared with $M = 9.96$ in the control group, yielding a mean difference of 9.50 points with a 95% CI [7.61, 11.38] and a very large standardised effect (Hedges' $g = 2.97$). In this setting, guided experimentation appears to provide an activity format that supports children's learning interest more strongly than worksheet-centred routines.

The practical implication is that early childhood teachers can increase learning interest by designing short, low-cost experimental sequences that foreground child agency and immediate feedback, organised through a simple sequence of questioning, prediction, action, observation, and explanation sharing. Interpretation should remain bounded because intact classes were compared without random assignment and learning interest was assessed through structured oral tests. Future studies should test repeated experimental activities across longer periods, triangulate learning interest using behavioural observation and teacher ratings, and apply baseline-adjusted analytic strategies to strengthen causal inference.

Declarations

Author Contribution Statement

Rahma Jihan Febriyanti: conceptualization, methodology, investigation, data curation, formal analysis, and writing the original draft. Amirul Mukminin: supervision, validation, methodology, and writing, review, and editing. All authors have read and approved the final version of the manuscript.

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Data Availability Statement

The dataset generated and analyzed during the research is available from the corresponding author upon reasonable request.

Declaration of Interests Statement

The authors declare no competing financial or personal interests.

Additional Information

No additional information is available for this paper at this time.

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