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Changes in Fifth-Grade Students' Mathematics Learning Motivation Before and After Blooket-Based Gamified Learning

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Abstract: This study aims to examine the change in the mathematics learning motivation of fifth-grade students at SD Negeri 101779 Percut before and after Blooket-based gamified learning. In this study, Blooket-based gamified learning refers to geometry lessons in which teacher-made Blooket quizzes were presented on the school's smartboard as a whole-class activity, with points, a leaderboard, and immediate feedback. A one-group pretest–posttest pre-experimental design was used with all 17 fifth-grade students (total sampling). The pretest was administered on 27 April 2026, the intervention lasted four lesson periods (4 × 35 minutes) over three meetings, and the posttest was administered on 4 May 2026. Learning motivation was measured with a 12-item, four-point Likert questionnaire based on the ARCS model (Attention, Relevance, Confidence, Satisfaction). Because the difference scores were normally distributed (Shapiro–Wilk $p = .084$), the change was tested with a paired-samples t-test and reported with Cohen's d_z and 95% confidence intervals. The mean motivation score increased from 40.94 ($SD = 4.56$) to 42.65 ($SD = 3.66$), a mean difference of 1.71 points (95% CI [−0.06, 3.48]), but the increase was not statistically significant, $t(16) = 2.04$, $p = .058$. The standardized change was moderate but imprecise ($d_z = 0.50$, 95% CI [−0.02, 0.99]). Ten students' scores increased, six decreased slightly, and one did not change. The change in motivation after Blooket-based gamified learning was therefore not statistically significant in this small one-group study; the results are preliminary and should be tested in controlled studies with larger samples.

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Introduction

Learning motivation, the internal and external drive that directs the intensity and persistence of students' learning, is a key condition for active engagement in elementary school (Ryan & Deci, 2020; Pujianingsih et al., 2024). In mathematics, this condition is particularly fragile. Elementary students often perceive mathematics as abstract, difficult, and boring, and teacher-centered lessons with little interaction tend to reinforce this perception (Kristanto, 2020; Nathaniel, 2023; Mailani et al., 2025). The consequences are visible in national outcomes: Indonesian 15-year-olds scored 366 points in mathematics in PISA 2022, far below the OECD average of 472, and most performed below the baseline proficiency level (OECD, 2023). Because attitudes toward mathematics begin to form in the elementary years, strategies that sustain students' motivation at this level are needed (Syuhada et al., 2024), particularly under the Merdeka Curriculum, which encourages active, differentiated, and enjoyable learning supported by technology (Febriansah et al., 2024).

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These difficulties were also found in the fifth-grade class of SD Negeri 101779 Percut, Deli Serdang Regency, North Sumatra. A preliminary observation was conducted in January 2026 during six lesson periods (6 × 35 minutes) of mathematics, using an observation sheet with three indicators: (a) students' participation in learning activities, (b) their willingness to answer the teacher's questions, and (c) their enthusiasm during the lesson. The observation showed that participation was low, that students were reluctant to answer questions, and that enthusiasm was limited; learning was largely one-way, with students positioned as passive recipients of information. Because these data come from a structured observation of a limited number of lessons, they are used here as contextual evidence of the problem; motivation itself was measured with the questionnaire described in the Research Method section.

At the same time, the school had received an interactive flat panel (hereafter, smartboard) through the national learning digitalization program, under which 172,550 panels had been delivered to schools across Indonesia by November 2025 (Naufal, 2025). Interactive boards offer large-screen visualization, touch input, and connectivity that can support two-way learning, but their benefits depend on whether teachers use them interactively rather than merely as display screens (Mokoena et al., 2022; Zhou et al., 2022). The combination of low observed participation in mathematics and an available shared smartboard formed the practical starting point of this study.

Gamification, the use of game elements such as points, badges, leaderboards, levels, and challenges in non-game activities, is one approach used to address low motivation. Unlike game-based learning, which places a complete game at the core of instruction, gamification embeds game mechanics into existing learning activities, including review and assessment activities (Febriansah et al., 2024). Meta-analyses and systematic reviews report positive but modest associations between gamification and motivational outcomes (Sailer & Homner, 2020; Ratinho & Martins, 2023; Kurnaz & Koçtürk, 2025); Sailer and Homner (2020), for example, estimated a small effect on motivational outcomes (g = 0.36). In Indonesian elementary schools, gamified media have been reported to increase students' motivation and participation (Nurningtias & Majid, 2022; Hakeu et al., 2023; Ibad, 2024; Rahmawati & Perdana, 2024; Valentinna et al., 2024).

Blooket is a web-based platform that turns teacher-created question sets into short games, with a variety of game modes, real-time scoring, immediate feedback on each answer, and a leaderboard (Aldayana & Andriyanti, 2025; Masri, 2026). In this study, the school used a premium (Blooket Plus) account, so all game modes available to that account could be used. Because the platform can be used in different ways, the term *Blooket-based gamified learning* in this study refers specifically to the following intervention: geometry lessons in which the teacher presented teacher-written Blooket quizzes on the classroom smartboard as a whole-class activity, and students answered the items directly on the touchscreen. Although the game modes differ in their storylines and mechanics, all of them share four game elements: teacher-written items aligned with the lesson objectives, points or in-game rewards for correct answers, immediate correct/incorrect feedback after each item, and a leaderboard, which in this study was displayed on the smartboard. Ways of using Blooket that rely on individual devices, such as students playing on their own devices or completing assignments outside class, were not part of the intervention; the study therefore examines this whole-class, smartboard-based use of Blooket rather than all possible uses of the platform. This form of use was chosen for three reasons: short rounds with immediate feedback were considered appropriate for fifth-grade students, who benefit from short tasks and quick confirmation of their answers; the quizzes could be run on the single smartboard in the classroom without students needing their own

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devices or accounts; and teacher-written items allowed the quizzes to follow the regular geometry material. Competitive elements, however, are not uniformly beneficial. Leaderboards and rankings invite social comparison, which can lower satisfaction and intrinsic motivation for some students (Hanus & Fox, 2015), and time pressure and fear of losing have been reported as stressors in competitive quiz platforms (Wang & Tahir, 2020). In a Blooket case study, the leaderboard motivated some primary students but served merely as information for others (Masri, 2026). Students' motivational responses were therefore expected to differ, which is why individual patterns of change were also examined.

To position the present study, Table 1 synthesizes empirical Blooket studies by educational level, subject, design, and outcome.

Table 1. Synthesis of Empirical Studies on Blooket by Level, Subject, Design, and Outcome

Study	Level and participants	Subject	Design	Outcome(s)	Main finding
Lo (2025)	Primary, Grade 6; *n* = 104; Taiwan	Science	Quasi-experimental; Blooket on tablets vs. paper quizzes	Self-determined motivation; learning effectiveness	Higher motivation in the Blooket group
Nurindah et al. (2025)	Primary, Grade 4; *n* = 70; Indonesia	Not stated (social studies implied)	Quasi-experimental, nonequivalent control group; Blooket vs. question cards	Learning motivation	Greater increase in the Blooket group
Masri (2026)	Primary 5; *n* = 4 (students with dyslexia); Singapore	Mathematics (fractions)	Qualitative case study	Perceived motivation and engagement	Perceived as engaging; leaderboard motivated some students only
Wongsaming et al. (2023)	Grade 7; two classes; Thailand	Mathematics	Quasi-experimental, pretest–posttest control group (TGT + Blooket)	Problem-solving ability	Higher than conventional instruction
Hundolo et al. (2026)	Grade 7; *n* = 20; Indonesia	Indonesian (listening)	Descriptive; no control group or pretest	Test scores; perceived motivation and engagement	Positive perceptions; most scores above the mastery criterion
Damayanti et al. (2026)	Grade 10 (vocational); two classes; Indonesia	Office management	Quasi-experimental, nonequivalent control group	Learning outcomes; engagement and perceptions	Greater learning gains than the control class
Sholihah et al. (2026)	Grade 11; *n* = 27; Indonesia	Mathematics (step functions)	Quantitative descriptive; no comparison	Learning enthusiasm	85.53% ("very high")
Juasih (2026)	Grade 12; *n* = 64; Indonesia	Mathematics (probability)	Quasi-experimental; one session	Motivation; learning outcomes	Larger increases in the Blooket class
Nabila & Nurhamidah (2024)	Grade 12 (vocational); *n* = 27; Indonesia	Indonesian	Descriptive (mixed)	Perceptions; evaluation results	Positive responses
Aldayana & Andriyanti (2025)	Senior high; Indonesia	English (vocabulary, reading)	Descriptive perception study	Perceptions	Positive perceptions
Huynh (2024)	University, first year; Vietnam	English	Action research (two cycles)	Motivation (SDT-based subscales)	Descriptive increase in intrinsic motivation

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Study	Level and participants	Subject	Design	Outcome(s)	Main finding
Present study	Primary, Grade 5; *n* = 17; Indonesia	Mathematics (geometry)	One-group pretest–posttest; Blooket quizzes on one shared smartboard	Learning motivation (ARCS)	See Results

Three patterns emerge from Table 1. First, most studies were conducted at the secondary or tertiary level and in language subjects; the mathematics studies were at the secondary level (Wongsaming et al., 2023; Juasih, 2026; Sholihah et al., 2026), and the only primary-level mathematics study was a qualitative case study of four students with dyslexia (Masri, 2026). Second, the two quantitative primary-level studies concerned science or social studies rather than mathematics (Nurindah et al., 2025; Lo, 2025), and where the mode of delivery was described, students played on individual devices (e.g., Lo, 2025). Whole-class play on a single shared smartboard, a configuration that is now common in Indonesian primary schools without one device per student, has not been examined. Third, most studies reported group means or percentages without examining whether individual students changed in the same direction, although research on competitive game elements suggests that responses may diverge (Hanus & Fox, 2015; Masri, 2026). The gap addressed here is therefore not merely a new location: it is the lack of evidence on how primary students' mathematics motivation changes, at both the group and the individual level, when Blooket quizzes are delivered as a whole-class activity on a shared smartboard.

Based on the discussion above, this study aims to examine the change in the mathematics learning motivation of fifth-grade students at SD Negeri 101779 Percut before and after Blooket-based gamified learning, as defined above. Because only one group was observed without a comparison condition, the study tests whether motivation scores changed from pretest to posttest; it does not attempt to establish a causal effect of the intervention. Three research questions were formulated. RQ1: Is there a statistically significant difference between students' mathematics learning motivation scores before and after Blooket-based gamified learning? RQ2: How large is the change, expressed as an effect size with a 95% confidence interval? RQ3: How consistent is the direction of change across individual students? For RQ1, the statistical hypotheses were H_0: $\mu_D = 0$ (the mean of the posttest–pretest differences equals zero) and H_1: $\mu_D \neq 0$ (two-tailed).

Research Method

Research design

This study used a quantitative approach with a one-group pretest–posttest pre-experimental design (Shadish et al., 2002; Sugiyono, 2020), represented as O_1 X O_2, in which the same students completed a motivation questionnaire before (O_1) and after (O_2) Blooket-based gamified learning (X). The study was conducted at SD Negeri 101779 Percut, Deli Serdang Regency, North Sumatra. This design was chosen for two reasons. First, all fifth-grade students at the school formed a single class of 17 students, so neither random assignment nor a parallel comparison class within the same school was possible, and a comparison class from another school would have differed in teachers, facilities, and smartboard use. Second, the study was intended as an initial exploration of the direction and magnitude of change, the results of which can inform the sample size of a subsequent controlled study. The pretest was administered on 27 April 2026, the intervention was then carried out, and the posttest was administered on 4 May 2026, so the interval between the two measurements was one week.

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Without a control group, a pretest–posttest difference may reflect influences other than the intervention. Following Shadish et al. (2002), six threats to internal validity were considered: history (other events between the two measurements), maturation (natural changes in students over time), testing (familiarity with the questionnaire after the pretest), instrumentation (differences in how the questionnaire was administered), regression toward the mean (students with extreme pretest scores tending to score closer to the group mean at posttest), and reactivity, including the novelty of the activity. Several features of the procedure reduced, though did not eliminate, these threats: the one-week interval between measurements limited the opportunity for maturation and for other events to intervene; the same questionnaire was used at pretest and posttest; the intervention was integrated into the class's regular geometry lessons rather than added as a separate program; and both questionnaires were administered in the same classroom with the same instructions. Regression toward the mean and novelty cannot be controlled procedurally in a single-group design; they are therefore considered when the results are interpreted.

Participants

The population consisted of all fifth-grade students at SD Negeri 101779 Percut in the 2025/2026 academic year, who formed a single class of 17 students. Because the population was small, all of its members were included through saturation (total) sampling, so the sample ($N = 17$) was identical to the population. The participants comprised eight boys and nine girls. The fifth-grade class was selected because the motivational problem described in the Introduction was observed in this class and because fifth-grade students are able to read and respond to the questionnaire independently. As only one class in one school was involved, the findings describe this group and cannot be generalized to fifth-grade students in other schools.

Intervention

The intervention lasted four lesson periods (4 × 35 minutes, 140 minutes in total), delivered in three meetings on three different days between the pretest and the posttest, and covered geometry, the regular mathematics material of the class at that time. Each meeting followed the same sequence: (1) opening and review of prior material; (2) explanation of the geometry material with examples displayed on the smartboard; (3) a Blooket quiz of teacher-written geometry items played on the smartboard, using the game modes available to the school's premium (Blooket Plus) account, which the teacher varied across quiz rounds; and (4) discussion of the items that many students answered incorrectly, followed by a summary. During the quiz, students competed to answer the items directly on the smartboard touchscreen, received immediate feedback after each item, and saw their positions on the leaderboard. The teacher's roles were to prepare question sets aligned with the lesson objectives, select the game mode for each round, operate the host screen, manage turns so that every student had an opportunity to answer, and give corrective explanations after each item.

Instrument

Learning motivation was measured with a 12-item questionnaire developed on the basis of Keller's ARCS model (Keller, 2010). Each item was rated on a four-point scale: strongly agree (4), agree (3), somewhat disagree (2), and disagree (1), so total scores could range from 12 to 48. The items were distributed equally across the four dimensions, three items each (Table 2). This allocation follows the structure of the ARCS model, in which each dimension comprises three subcategories (Keller, 2010); each item was written to represent one subcategory. The items were written in simple Indonesian suited to fifth-grade students and referred to concrete situations in mathematics lessons, and the clarity of their language was one

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of the aspects assessed by the validators. Table 2 presents the dimensions, indicators, item numbers, and one sample item for each dimension.

Table 2. Dimensions, Indicators, and Sample Items of the Learning Motivation Questionnaire

Dimension	Indicators (ARCS subcategories; Keller, 2010)	Items	Sample item (English translation)
Attention	Perceptual arousal; inquiry arousal; variability	1–3	I feel interested in following mathematics lessons in class.
Relevance	Goal orientation; motive matching; familiarity	4–6	The mathematics material I learn is useful in my daily life.
Confidence	Learning requirements; success opportunities; personal control	7–9	I am confident that I can solve the mathematics problems given by the teacher.
Satisfaction	Intrinsic reinforcement; extrinsic rewards; equity	10–12	I feel happy when I answer mathematics problems correctly.
Total		**12**	

Note. Sample items are English translations of the Indonesian originals. Responses: strongly agree (4), agree (3), somewhat disagree (2), disagree (1); total score range 12–48.

Content validity was examined through expert judgment by two validators with expertise in learning and assessment. Each validator reviewed every item on three aspects, namely (a) alignment of the item with its indicator, (b) accuracy in representing the ARCS dimension, and (c) clarity of the language for fifth-grade students, and judged whether the item was appropriate on each aspect. An item was considered fit for use when both validators judged it appropriate on all three aspects. Both validators judged all 12 items appropriate; their suggestions were limited to minor editorial revisions, which were made before the instrument was used, and no item was removed. Because the expert judgment was recorded qualitatively, no quantitative content validity index is reported. No empirical analysis of construct validity, such as factor analysis, was conducted either, because a sample of 17 students is far too small for such procedures. Validity evidence in this study is therefore limited to qualitative content validation, and this limitation is considered when interpreting the results.

Motivation categories

To describe motivation levels, total scores were classified into five categories using an interval width derived from the theoretical score range of the instrument, $i = (48 - 12)/5 = 7.2$. The resulting categories are very low (12–19), low (20–26), moderate (27–33), high (34–40), and very high (41–48). Because the boundaries depend only on the minimum and maximum possible scores of the instrument, they were determined independently of, and before, the analysis of the observed data. The categories are used only for description; the statistical test was conducted on the continuous scores.

Data analysis

The data were analyzed with SPSS in four steps. First, descriptive statistics (minimum, maximum, mean, median, and standard deviation) were computed for the pretest, the posttest, and the difference score (D = posttest − pretest), and the numbers of students whose scores increased, decreased, or did not change were counted. Second, internal consistency was estimated with Cronbach's alpha separately for the pretest and the posttest, because reliability is a property of the scores obtained in a particular administration rather than a fixed property of an instrument (Taber, 2018); 95% confidence intervals for alpha were computed with Feldt's method (Feldt et al., 1987) to show the imprecision of estimates from a small sample.

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Third, the prerequisite for the paired-samples t-test was examined. Because this test compares the mean of the paired differences with zero, its normality assumption concerns the distribution of D, not the pretest and posttest scores separately. Normality was therefore tested on D with the Shapiro–Wilk test, which is suited to small samples, and the paired-samples t-test was applied after this prerequisite was met ($p > .05$). Fourth, to answer RQ1, the paired-samples t-test was conducted two-tailed at $\alpha = .05$. To answer RQ2, the mean difference was reported with its 95% confidence interval, and the standardized change was computed as Cohen's d_z (the mean difference divided by the standard deviation of D) with a 95% confidence interval (Lakens, 2013), interpreted against Cohen's (1988) benchmarks (0.2 small, 0.5 medium, 0.8 large) as rough guides. RQ3 was answered descriptively from the individual difference scores.

Result and Discussion

Descriptive results and individual change

Each student's pretest and posttest scores, the difference between them, and the corresponding categories are presented in Table 3.

Table 3. Individual Learning Motivation Scores, Categories, and Changes

Student	Pretest	Category	Posttest	Category	D	Direction
S1	45	VH	46	VH	+1	Increase
S2	38	H	35	H	−3	Decrease
S3	39	H	41	VH	+2	Increase
S4	41	VH	40	H	−1	Decrease
S5	43	VH	48	VH	+5	Increase
S6	40	H	42	VH	+2	Increase
S7	34	H	41	VH	+7	Increase
S8	41	VH	48	VH	+7	Increase
S9	46	VH	45	VH	−1	Decrease
S10	46	VH	44	VH	−2	Decrease
S11	42	VH	42	VH	0	No change
S12	29	M	38	H	+9	Increase
S13	43	VH	42	VH	−1	Decrease
S14	38	H	39	H	+1	Increase
S15	40	H	42	VH	+2	Increase
S16	46	VH	48	VH	+2	Increase
S17	45	VH	44	VH	−1	Decrease
Mean	**40.94**		**42.65**		**+1.71**	**10 ↑ / 6 ↓ / 1 =**

Note. D = posttest − pretest. VH = very high (41–48); H = high (34–40); M = moderate (27–33).

As shown in Table 4, the mean motivation score was 40.94 (SD = 4.56) on the pretest and 42.65 (SD = 3.66) on the posttest, a mean difference of 1.71 points (median = 1). Relative to the maximum possible score of 48, these means correspond to 85.3% and 88.8%, respectively. The difference scores ranged from −3 to +9 (SD = 3.44), which shows that the mean change was small relative to the variation between students.

Table 4. Descriptive Statistics of Pretest, Posttest, and Difference Scores

Score	*N*	Min	Max	Mean	Median	*SD*
Pretest	17	29	46	40.94	41	4.56
Posttest	17	35	48	42.65	42	3.66
Difference (D)	17	−3	+9	+1.71	+1	3.44

Note. D = posttest − pretest; possible range of pretest and posttest scores = 12–48.

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The mean, however, conceals considerable variation between students (Table 3; Figure 1), which answers RQ3. Ten students (58.8%) had higher scores at posttest, with increases from +1 to +9 points (mean = +3.8); six students (35.3%) had lower scores, with decreases from −1 to −3 points (mean = −1.5); and one student (5.9%) showed no change. Four of the six decreases were of one point, equivalent to a one-step change in the response to a single item, and seven students (41.2%) changed by no more than one point in either direction. The four largest increases (+5 to +9 points; S5, S7, S8, and S12) accounted for almost all of the increase in the class mean: the remaining 13 students changed by +0.08 points on average. The direction of change was therefore not consistent across students.

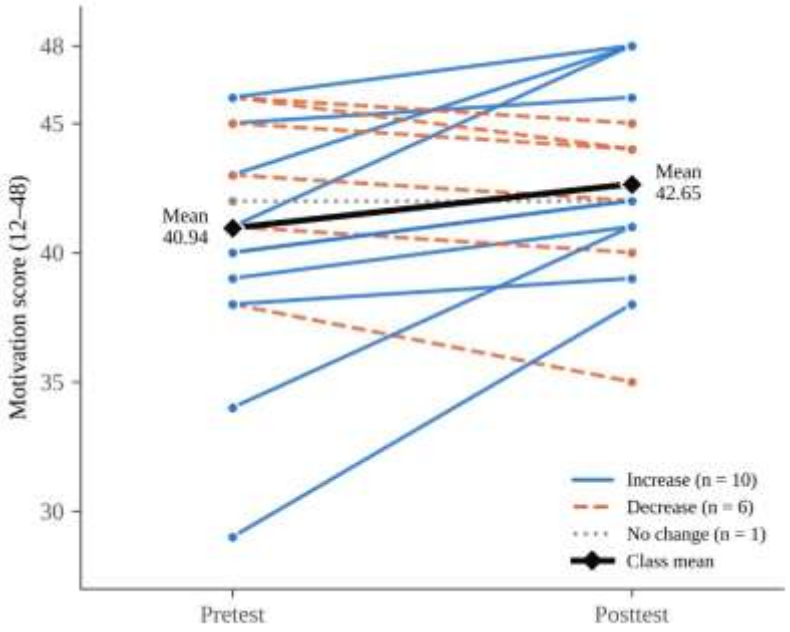


Figure 1. Individual pretest and posttest motivation scores (n = 17)

Motivation categories before and after the intervention

Table 5 shows that the number of students in the very high category increased from 10 to 13 and that the only student in the moderate category at pretest (S12) moved to the high category. Five students moved up one category (S3, S6, S7, and S15 from high to very high, and S12 from moderate to high), one student moved down (S4, from very high to high), and eleven remained in the same category. These shifts should be read with caution: three of the upward shifts (S3, S6, and S15) resulted from gains of only two points across the boundary between 40 and 41, and the downward shift of S4 resulted from a one-point decrease across the same boundary.

Table 5. Distribution of Learning Motivation Categories

Category	Score range	Pretest *f*	Pretest %	Posttest *f*	Posttest %
Very high	41–48	10	58.8	13	76.5
High	34–40	6	35.3	4	23.5
Moderate	27–33	1	5.9	0	0.0
Low	20–26	0	0.0	0	0.0
Very low	12–19	0	0.0	0	0.0
Total		**17**	**100.0**	**17**	**100.0**

Note. Class width $i = (48 - 12)/5 = 7.2$, based on the theoretical score range.

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Reliability and normality

Internal consistency was α = .740 at pretest and α = .679 at posttest (Table 6). Reliability was estimated separately for each administration because alpha depends on the variability of scores on a particular occasion (Taber, 2018). This matters here, because the posttest scores were less variable (*SD* = 3.66) than the pretest scores (*SD* = 4.56), which by itself tends to lower alpha. With only 17 respondents, both estimates are imprecise: the 95% confidence intervals were .51–.89 for the pretest and .40–.86 for the posttest (Feldt et al., 1987). The pretest value can be regarded as acceptable for research purposes, but the posttest value falls below the commonly used .70 benchmark, and its lower confidence limit shows that the true reliability could be considerably lower. The posttest scores, and therefore the difference scores, thus contain a non-trivial amount of measurement error, and small individual changes (±1 point) in particular should not be over-interpreted.

Table 6. Reliability of the Scores and Normality of the Difference Scores

Statistic	Pretest	Posttest	Difference (D)
Cronbach's α (12 items)	.740	.679	–
95% CI for α (Feldt)	[.511, .890]	[.397, .864]	–
Shapiro–Wilk *W*	–	–	0.906
Shapiro–Wilk *p*	–	–	.084

Note. $N = 17$. Normality was tested only on D, because the paired-samples t-test assumes normally distributed difference scores.

The Shapiro–Wilk test showed that the difference scores did not deviate significantly from a normal distribution ($W = 0.906$, $p = .084 > .05$). The prerequisite of the paired-samples t-test was therefore met, and the paired-samples t-test was used to test the hypothesis.

Paired-samples t-test (RQ1 and RQ2)

The paired-samples t-test showed that the mean increase of 1.71 points was not statistically significant, $t(16) = 2.04$, $p = .058$, two-tailed (Table 7). H_0 was therefore not rejected: the data do not provide sufficient evidence of a significant change in mathematics learning motivation after Blooket-based gamified learning. The 95% confidence interval for the mean difference (−0.06 to 3.48 points) includes zero, so the data are compatible both with no change and with an increase of up to about 3.5 points. The standardized change was $d_z = 0.50$, a medium value by Cohen's (1988) benchmarks, but its 95% confidence interval (−0.02 to 0.99) was wide, ranging from no change to a large one.

Table 7. Results of the Paired-Samples t-Test

Mean D	SD_D	*SE*	95% CI of mean D	*t*	*df*	*p* (two-tailed)	d_z [95% CI]
1.71	3.44	0.83	[−0.06, 3.48]	2.04	16	.058	0.50 [−0.02, 0.99]

Note. $N = 17$; D = posttest − pretest. H_0: $\mu_D = 0$; H_1: $\mu_D \neq 0$; $\alpha = .05$.

With 17 students, the study had 80% power to detect only changes of $d_z \geq 0.72$ (two-tailed, $\alpha = .05$); about 34 students would be needed to detect a change of the observed size ($d_z = 0.50$) with 80% power. The non-significant result should therefore be interpreted as inconclusive rather than as evidence that motivation does not change after Blooket-based gamified learning.

Discussion

The empirical findings can be summarized as follows. After Blooket-based gamified learning, the class mean motivation score was 1.71 points higher than before, but this difference was not statistically significant and its confidence interval included zero. The standardized change was moderate in size but imprecise. Most of the mean increase came from four students, and six

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students' scores decreased slightly. These findings answer the three research questions; the following paragraphs separate them from comparisons with earlier studies, from theory-based interpretations, and from alternative explanations that the design cannot rule out.

The direction of change is consistent with controlled studies in which Blooket groups reported higher motivation than comparison groups, such as fourth graders using Blooket rather than question cards (Nurindah et al., 2025) and sixth graders using Blooket rather than paper quizzes in science (Lo, 2025), and with the positive but modest associations between gamification and motivation reported in meta-analyses (Sailer & Homner, 2020; Kurnaz & Koçtürk, 2025). The present estimate (d_z = 0.50) is a within-group value and is not directly comparable to between-group estimates, but its magnitude is in a broadly similar range to the meta-analytic estimate for motivational outcomes (g = 0.36; Sailer & Homner, 2020). Unlike several earlier Blooket studies that reported high post-intervention percentages or significant group differences (e.g., Juasih, 2026; Sholihah et al., 2026), the present study did not find a statistically significant change. Three features of the study may account for this: the small sample and resulting low power; the high initial motivation level, which left limited room for increase; and the whole-class format on a single smartboard, in which each student personally answered fewer items than students who play on individual devices.

The high initial level deserves careful interpretation. The pretest mean of 40.94 corresponds to 85.3% of the maximum possible score (40.94/48 × 100) or, expressed as a percentage of the possible range above the minimum score of 12, to 80.4% ((40.94 − 12)/(48 − 12) × 100). These figures alone do not demonstrate a ceiling effect, which requires a substantial proportion of scores at or near the maximum. The individual data show that no student obtained the maximum score at pretest (the highest score, 46, was obtained by three students), that five students (29.4%) scored 44 or more, and that three students reached 48 at posttest; the mean distance to the maximum at pretest was 7.06 points. The data therefore indicate a relatively high baseline with limited room for further increase rather than a strict ceiling effect. This limited room may have constrained the increase among students who started high: the seven students with pretest scores of 40 or below increased by 2.86 points on average, whereas the ten students with pretest scores above 40 increased by 0.90 points. Because students with extreme initial scores also tend to score closer to the average when measured again (regression toward the mean; Barnett et al., 2005), this pattern should not be interpreted as a different response to the intervention.

From a theoretical perspective, self-determination theory offers a potential explanation for why some students' motivation increased. Immediate feedback and points could support the need for competence, and playing together in front of a shared screen could support relatedness (Ryan & Deci, 2020). Opportunities for autonomy were more limited, because the teacher controlled the pace of play and the choice of items. These mechanisms were not measured: no data were collected on students' perceived autonomy, competence, or relatedness. They should therefore be regarded as possible explanations to be tested in future studies, not as mechanisms demonstrated by the present data.

Similarly, the ARCS model suggests how the features of the intervention could relate to each dimension of motivation: the novelty of the game, the variation of game modes, and the large display could attract Attention; items based on the current mathematics material could support Relevance; immediate feedback and repeated opportunities to answer could build Confidence; and points, the leaderboard, and recognition of success could provide Satisfaction (Keller, 2010). This mapping is a theoretical interpretation, not an empirical finding for each dimension. The analysis used only the total score; separate analyses of the four dimensions

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were not conducted because each dimension was measured by only three items, and with 17 students the reliability of such short subscales would be low and highly uncertain, so dimension-level comparisons could be misleading. Consequently, this study cannot show which dimension, if any, changed after the intervention.

The decreases observed in six students also require interpretation. Competitive features such as leaderboards can reduce satisfaction or intrinsic motivation for some students through social comparison (Hanus & Fox, 2015), and time pressure or fear of losing may cause stress (Wang & Tahir, 2020). Such responses are a plausible reason why the intervention might not benefit every student. The present data, however, cannot confirm this interpretation: students' leaderboard positions and perceived pressure were not recorded; the students whose scores decreased were those with relatively high initial motivation rather than those likely to rank low; and four of the six decreases were of only one point, a change within the range expected from measurement error given the modest posttest reliability. Future studies should record students' rankings and perceived pressure to examine whether competition has different consequences for different students.

Besides regression toward the mean, several alternative explanations remain plausible for the observed increase. A testing effect may have occurred because students completed the same questionnaire twice; the novelty of playing varied Blooket game modes on the smartboard may have produced a short-term rise in enthusiasm that would fade with repeated use; students may have responded more favorably after an enjoyable activity because of social desirability; and other events at school during the study period (history) could have influenced their motivation. Moreover, the intervention was a package that combined the smartboard, the Blooket game format, points, the leaderboard, immediate feedback, and the teacher's facilitation. Even if the change were attributable to the intervention, the design does not allow the contribution of each component to be separated.

The findings also relate to research on interactive boards, which indicates that such devices support engagement when they are used interactively rather than merely as display screens (Mokoena et al., 2022; Zhou et al., 2022). In this study, the smartboard served as a shared participation medium on which students took turns answering through the touchscreen. Whether this form of use contributes to motivation beyond the quiz itself is an open question that requires comparing the same quiz delivered with and without the smartboard.

In view of the design and the results, the contribution of this study is modest and specific. First, it documents a replicable way of implementing Blooket-based gamified learning with a single shared smartboard in a primary classroom without one device per student, including the sequence of each meeting and the teacher's roles. Second, by reporting individual as well as group changes, it shows that a positive mean change can mask heterogeneous responses, with most of the increase concentrated among a few students; most earlier Blooket studies, which reported only group means or percentages, did not provide this information. Third, it provides an effect-size estimate with a confidence interval that can be used to plan the sample size of controlled studies. The study does not provide evidence that Blooket-based gamified learning is effective in increasing motivation.

The practical implications are limited to contexts similar to the one studied, namely small primary classes in schools that have received a smartboard but do not have devices for every student. In such contexts, teachers may consider smartboard-delivered Blooket quizzes as one option for reviewing material or conducting formative assessment, noting that some of the game modes used here require a premium account, but they should not expect uniform increases in motivation. Teachers are advised to observe individual students' reactions, to

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ensure that every student has an equal opportunity to answer, and to reduce the emphasis on rankings, for example by highlighting team scores or individual improvement, for students who may feel pressured by competition. Recommendations for wider or routine use would require evidence from controlled studies with larger and more diverse samples of students and schools.

Several limitations directly constrain the interpretation of these results. First, the absence of a control group means that the observed change cannot be attributed to the intervention, because history, testing, novelty, and regression toward the mean remain plausible explanations; the results describe change after the intervention, not a demonstrated effect. Second, the small sample from a single class in one school limited statistical power (only changes of $d_z \geq 0.72$ could be detected reliably), produced wide confidence intervals, and prevents generalization beyond this group. Third, motivation was measured only by self-report, validity evidence was limited to qualitative expert judgment, and the posttest reliability was modest; measurement error and social desirability may have influenced the scores, so small individual changes should not be over-interpreted. Fourth, the intervention was short (four lesson periods in three meetings within one week), and motivation was measured only once afterwards, so it is unknown whether any change would persist or fade once the novelty wore off. Fifth, only the total motivation score was analyzed, so no conclusions can be drawn about specific ARCS dimensions. Finally, because the intervention combined several components, their separate contributions cannot be identified.

Conclusion

Blooket-based gamified learning, implemented as smartboard-delivered Blooket quizzes in four lesson periods of geometry over three meetings, was followed by an increase in the mean mathematics learning motivation score of fifth-grade students at SD Negeri 101779 Percut from 40.94 to 42.65 (mean difference = 1.71 points). However, the increase was not statistically significant ($t(16) = 2.04$, $p = .058$), and its 95% confidence interval (−0.06 to 3.48) included zero; the study therefore did not find a statistically significant change in students' learning motivation after Blooket-based gamified learning. The standardized change was moderate ($d_z = 0.50$) but imprecise, and individual responses varied: ten students' scores increased, six decreased slightly, and one did not change. Given the one-group design and the small sample, these results are preliminary and justify testing Blooket-based gamified learning in controlled studies with larger samples.

Recommendation

Because the findings are preliminary, they do not support a recommendation for routine use of Blooket in mathematics instruction. Teachers in similar contexts may try smartboard-delivered Blooket quizzes as an occasional formative review activity while monitoring how individual students respond. Future research should (1) use a quasi-experimental or randomized design with a comparison group taught the same material without Blooket, for example with the same items presented without game elements, so that the contribution of the gamified quiz can be isolated; (2) involve larger samples from several schools, with at least about 34 students for a paired design to detect a change of the size observed here and more for between-group comparisons; (3) measure motivation at several time points, including a delayed posttest, to assess whether changes persist; (4) use instruments with enough items per ARCS dimension to allow reliable dimension-level analysis; and (5) complement self-report with observations of engagement and records of students' leaderboard positions and perceived pressure.

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