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THE EFFECT OF THE GASING LEARNING METHOD ON STUDENTS' NUMERACY VIEWED FROM LEARNING STYLES

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ABSTRACT

Numeracy is the ability to apply mathematical concepts in everyday life. PISA 2025 assesses mathematical literacy, a construct closely related to numeracy, and Indonesian students scored 364 in mathematics, below the OECD average of 463. This study examined whether the effect of the GASING learning method on students' numeracy gain, compared with direct instruction, differs by learning style (visual, auditory, and kinesthetic). A quasi-experimental pretest–posttest control group design with a 2×3 factorial structure was used with 98 Grade VII students (GASING n = 50; direct instruction n = 48) from three schools in Morotai Island Regency, Indonesia, selected through purposive sampling. Numeracy gain was expressed as N-Gain from a five-item essay test, and learning style was classified with a 30-item questionnaire. Because variances were heterogeneous (Levene's $F(5, 92) = 7.48$, $p < 0.001$), a two-way linear model with HC3 heteroskedasticity-consistent inference was used. GASING produced higher N-Gain than direct instruction ($M = 0.814$ vs. 0.613), $F(1, 92) = 5297.90$, $p < 0.001$, partial $\eta^2 = 0.984$, 95% CI [0.981, 0.989], and in every learning-style group (mean differences 0.177 to 0.233). The method × learning style interaction was significant, $F(2, 92) = 28.48$, $p < 0.001$, partial $\eta^2 = 0.414$, and concerned the size of the GASING advantage, which was largest for kinesthetic and smallest for visual students, not its direction. Within-group variability was very small, so standardized effects should be read with caution.

Keywords: GASING Learning Method, Students' Numeracy, Learning Style, Interaction Effect.

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PRELIMINARY

Numeracy is an essential 21st-century life skill with eight major components: mathematical reasoning, argumentation, communication, modeling, posing and solving problems, representations, symbols, and tools and technology (Rizki & Priatna, 2019). It is the ability to apply mathematical concepts and skills in everyday life (Adelia et al., 2024; Andriatna et al., 2024; Anwar, Kusumah, & Priatna, 2026; Anwar, Kusumah, Priatna, et

al., 2026; Jain & Rogers, 2019) across social, cultural, historical, and political contexts (Bellini et al., 2019; Sa'dijah et al., 2023; Yasukawa et al., 2018). Aris et al. (2025) showed that strong numeracy supports academic performance across disciplines, and early numeracy is a foundation for long-term success in mathematics and in the workforce (Aunio, 2019).

Numeracy is nevertheless difficult to teach (Adelia et al., 2024), partly because students rely on memorized formulas without conceptual understanding (Winarni et al., 2025), and many adults struggle with it (Tout, 2020). In PISA 2025, which assessed mathematical literacy, a construct closely related to numeracy (OECD, 2026a), Indonesian students ranked 78th out of 91 countries with an average score of 364, 99 points below the OECD average (OECD, 2026b).

Differences in students' numeracy may be related to how they prefer to receive and process information (Yerizon et al., 2025). These preferences are commonly described as learning styles (Dehghani & Ghaffarifar, 2024; Murthy, 2016), which are often proposed as a way to personalize learning (Sharuni et al., 2024). Munahefi et al. (2024) related visual, auditory, and kinesthetic preferences to mathematics performance. However, evidence that matching instruction to a preferred style improves learning is weak (Pashler et al., 2008), which leaves open whether the benefit of a teaching method is the same for all learners.

GASING stands for Gampang, Asyik, and Menyenangkan (Easy, Fun, and Enjoyable). It was created by Prof. Yohanes Surya, an Indonesian physicist and mathematics educator, and uses songs, games, and hands-on activities (Surya, 2024). The method has three sequential stages. In the Concrete stage, students manipulate real objects or visual representations to build the concept (Kaya & Yildiz, 2024; Prosser & Bismarck, 2023; Ughi, 2020). In the Abstract stage, they move to symbols such as numbers, variables, and operators. In Mencongak, they calculate mentally without external tools, which supports number sense and cognitive flexibility (Lemonidis, 2016) and rests on understanding rather than rote memorization. Earlier studies found better multiplication understanding and interest (Hendriana et al. (2019)), better multiplication concept understanding and application than traditional teaching (Pratiwi et al. (2021)), and improved division problem solving among students with intellectual disabilities (Nuari et al., 2019).

Previous GASING studies have mostly examined arithmetic operations such as multiplication and division and reported average effects (Armianti et al., 2016; Hendriana

et al., 2019; Lestari & Hardini, 2022; Nuari et al., 2019; Pratiwi et al., 2021; Rumajar et al., 2024; Situmorang et al., 2024). Three questions remain open: whether the concrete–abstract–mencongak sequence improves numeracy, that is, the use of mathematics in context; whether it works in remote schools without a mathematics teacher, which to our knowledge have received little attention; and whether average effects hide differences between students with different learning preferences. Studies relating learning styles to mathematics performance (Maquiling & Desabella, 2025; Munahefi et al., 2024) show associations with outcomes but do not estimate how much the benefit of a particular method differs across styles. Treating learning style as a moderator, rather than as a prescription for matching, allows a more careful question: does the benefit of GASING differ across student groups, and by how much?

This study examines whether the GASING learning method produces higher numeracy gains than direct instruction among Grade VII students in remote schools, and whether this effect differs among students with visual, auditory, and kinesthetic learning styles. Learning style is treated as an observed moderator and was not used to assign students to instruction. The research questions are: (1) Does GASING produce higher numeracy gains than direct instruction? (2) Do numeracy gains differ among students with visual, auditory, and kinesthetic learning styles? (3) Does the effect of the method depend on learning style, and how large is the GASING advantage within each learning style?

METHODS

Research Design

This study employs a quantitative approach with a quasi-experimental research design using a pretest–posttest control group. The quantitative approach is chosen because the data collected are in the form of numerical scores and will be analyzed statistically, whereas the quasi-experimental design is selected because the researcher cannot fully control external variables that may influence the results, such as class assignments determined by the school, students' age, and their prior academic abilities.

The research design involves two factors: (1) the learning method factor (GASING learning method versus direct instruction method) and (2) the learning style factor (visual, auditory, and kinesthetic). Thus, this study adopts a 2×3 factorial design, aiming to examine the effect of each treatment variable (learning method and learning style) separately, as well as the interaction effect of these two treatment variables together on

students' numeracy improvement. The 2×3 factorial design used in this study is presented in Table 1 below.

Table 1. 2×3 Factorial Design

Learning Method (Factor A)	Learning Style (Factor B)		
	Visual (B_1)	Auditory (B_2)	Kinesthetic (B_3)
GASING Learning Method (A_1)	(A_1B_1)	(A_1B_2)	(A_1B_3)
Direct Instruction (A_2)	(A_2B_1)	(A_2B_2)	(A_2B_3)

Research Instruments

Three instruments were used: a numeracy test, a learning style questionnaire, and an observation sheet. The test has five essay items covering three numeracy indicators (understanding procedures, formulating information, and applying arithmetic operations), so the findings refer to these indicators. Items were scored with a rubric (easy items 0–10, moderate 0–15, difficult 0–20; maximum 100). The same test was used as pretest and posttest, and numeracy improvement was expressed as N-Gain = (posttest score − pretest score) / (maximum score − pretest score) (Hake, 1998).

Learning style was classified with a 30-item Likert-scale questionnaire (five response options scored 1 to 5) with three sections of 10 items each (visual, auditory, and kinesthetic), so each section score ranges from 10 to 50. The section with the highest score indicates the student's learning style.

The observation sheet is a checklist for examining whether the teaching method (GASING or direct instruction) was carried out according to the planned learning steps. Three mathematics education experts validated it and judged it feasible for use, and its reliability (Cronbach's Alpha) was good.

Participants

The population was all Grade VII students in Morotai Island Regency, North Maluku Province, in the 2025/2026 academic year. Using purposive sampling, 98 students from three schools were selected and divided into an experimental group (n = 50), taught with the GASING learning method, and a control group (n = 48), taught with direct instruction (Table 2). The students showed about the same level of ability. The three schools were accredited level C (adequate), located far from the city center, and had no mathematics teacher.

Table 2. Number of Samples

Groups	Learning Style			N	Learning Method
	Visual	Auditory	Kinesthetic		
Experiment	18	20	12	50	GASING Learning Method
Control	17	19	12	48	Direct Instruction

Total	35	39	24	98

Intervention Procedure

Both groups studied the same material, namely Operations on Integers, over eight sessions, each lasting 80 minutes, during the first semester of the 2025/2026 academic year. In the first session, the teacher administered the pretest and identified the students' learning styles using a learning-style questionnaire. From the second to the seventh session, the teacher implemented the intervention by applying the learning method assigned to each group: the GASING group received instruction using the GASING learning method, whereas the DI group received direct instruction. In the eighth session, the posttest was administered to both groups.

In the GASING group, each session followed the three stages of GASING: concrete, abstract, and mental calculation (*mencongak*) (Surya, 2024), supported by songs, games, and hands-on activities. In contrast, the DI group followed six stages: (1) Review and Set the Stage, (2) Presentation of New Material, (3) Guided Practice, (4) Correction and Feedback, (5) Independent Practice, and (6) Review and Wrap-up (Archer & Hughes, 2010; Rosenshine, 2012).

The learning process was monitored using an observation sheet tailored to each group to determine whether the instruction followed the prescribed steps. If any errors or inconsistencies occurred during the learning process, the session was discontinued and rescheduled for another time.

Data Analysis

Normality was assessed with the Shapiro–Wilk test within the six cells and on the model residuals, and homogeneity of variance with Levene's test (based on the mean) and the Brown–Forsythe test (based on the median). The significance level was $\alpha = 0.05$, with Bonferroni-adjusted p-values for each family of follow-up comparisons.

Because the variances were heterogeneous and the cell sizes unequal (n = 12 to 20), inference used heteroskedasticity-consistent standard errors (HC3), as recommended in recent methodological literature (Rajh-Weber et al., 2025; Sladekova & Field, 2025; Wilcox & Rousselet, 2023), HC3 performs better than other estimators in samples of fewer than 250 observations (Long & Ervin, 2000).

The model was a two-way factorial linear model of N-Gain (learning method, learning style, and their interaction) fitted by ordinary least squares with sum-to-zero coding, equivalent to Type III tests in the univariate General Linear Model. Omnibus

effects were tested with HC3 Wald F statistics (92 residual degrees of freedom). Follow-up contrasts of the six cell means used HC3 standard errors in three families of three comparisons, each Bonferroni-adjusted: the GASING − direct instruction difference within each learning style, the differences between these differences (interaction contrasts), and comparisons among learning styles within each method.

Effect sizes are partial η^2 from the Type III sums of squares (95% confidence intervals from 2,000 stratified bootstrap resamples) and Hedges' g for comparisons between two cells. Sensitivity analyses used the classical two-way ANOVA and Welch t tests. Analyses were run in Python 3.12 with statsmodels 0.15.0 and SciPy 1.18.1.

Three hypotheses were tested. H1: mean N-Gain is higher with GASING than with direct instruction. H2: mean N-Gain differs among visual, auditory, and kinesthetic students. H3: the GASING − direct instruction difference differs across learning styles (interaction); if supported, simple effects were examined.

RESULT AND DISCUSSION

Result

1. Prerequisite Test Result

Before conducting the hypothesis testing using statistical tests, prerequisite tests (namely the normality and homogeneity tests) were performed first. Normality was tested with the Shapiro–Wilk test (Table 3). All six cells ($p = 0.070$ to 0.829) and the residuals of the fitted model ($W = 0.988$, $p = 0.501$) had $p > 0.05$, so the normality assumption was considered satisfied.

Table 3. Tests of Normality

Group	Shapiro-Wilk		
	Statistic	Df	Sig.
GASING – Visual	0.906	18	0.072
GASING – Auditory	0.937	20	0.208
GASING – Kinesthetic	0.963	12	0.829
Direct Instruction – Visual	0.901	17	0.070
Direct Instruction – Auditory	0.923	19	0.127
Direct Instruction – Kinesthetic	0.917	12	0.265
Model residuals	0.988	98	0.501

After the normality test, the homogeneity test was conducted next to determine whether the variances across groups were equal. Levene's test (Table 4) indicated heterogeneous variances across the six cells, $F(5, 92) = 7.48$, $p < 0.001$; the Brown–Forsythe version, which is less sensitive to non-normality, agreed, $F(5, 92) = 4.19$, $p =$

0.002. The largest cell standard deviation (0.0200) was about 3.2 times the smallest (0.0063).

Table 4. Test of Homogeneity of Variance

Test	Levene Statistic	df1	df2	Sig.
Levene (based on the mean)	7.483	5	92	< 0.001
Brown–Forsythe (based on the median)	4.195	5	92	0.002

Because the variances were heterogeneous and the cell sizes unequal, the p-values of the classical two-way ANOVA could be unreliable. The analysis therefore used a linear model with HC3 heteroskedasticity-consistent covariance estimates, as recommended by Wilcox and Rousselet (2023) and Rajh-Weber et al. (2025). The classical analysis is reported as a sensitivity check below Table 6.

2. Descriptive Statistics

Descriptive analysis reveals that students' numeracy enhancement, based on N-Gain numeracy scores, varies across learning method groups and learning styles. Table 5 shows the mean N-Gain of the GASING group (M = 0.8145, SD = 0.0228) was higher than that of the direct instruction group (M = 0.6131, SD = 0.0256). Scores varied little within cells (SD from 0.0063 to 0.0200; coefficient of variation 0.8% to 3.1%), which matters for the interpretation of effect sizes (see Discussion).

Table 5. Descriptive Statistics

Group	Learning Style	Mean	Std. Deviation	N
GASING	Visual	0.8151	0.0063	18
	Auditory	0.7946	0.0107	20
	Kinesthetic	0.8465	0.0147	12
	Total	0.8145	0.0228	50
Direct Instruction	Visual	0.6380	0.0200	17
	Auditory	0.5906	0.0136	19
	Kinesthetic	0.6135	0.0094	12
	Total	0.6131	0.0256	48

In every learning-style category, the GASING group had the higher mean N-Gain (Figure 1). The highest mean was found among kinesthetic students taught with GASING (0.8465) and the lowest among auditory students taught with direct instruction (0.5906). Within the GASING group the order was kinesthetic > visual > auditory, whereas within the direct instruction group it was visual > kinesthetic > auditory.

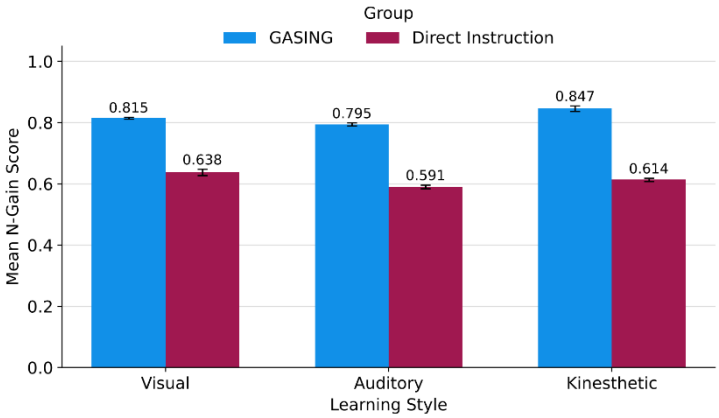


Figure 1. Mean N-Gain Numeracy Score by Learning Method and Learning Style

3. Statistical Test Results

The omnibus tests come from a two-way linear model (learning method × learning style) with sum-to-zero coding, Type III sums of squares, and HC3 covariance estimates; F is the Wald F statistic with 92 residual degrees of freedom (Table 6).

Table 6. Tests of Learning Method, Learning Style, and Their Interaction (HC3)

Source	Type III Sum of Squares	df	Mean Square	F (HC3)	Sig.	Partial η² [95% CI]
Learning Method	0.9829	1	0.9829	5297.90	< 0.001	0.984 [0.981, 0.989]
Learning Style	0.0295	2	0.0147	85.40	< 0.001	0.650 [0.590, 0.733]
Learning Method * Learning Style	0.0112	2	0.0056	28.48	< 0.001	0.414 [0.310, 0.546]
Error	0.0159	92	0.00017			

Note. F is the HC3 Wald F; sums of squares, mean squares, and partial η² come from the classical Type III decomposition. Sensitivity check (classical F): method = 5686.52, learning style = 85.30, interaction = 32.51, all $p < 0.001$. The residual standard deviation was 0.0131.

Learning method had a significant effect on N-Gain, $F(1, 92) = 5297.90$, $p < 0.001$, partial $\eta^2 = 0.984$, 95% CI [0.981, 0.989]. The mean difference between methods was large, about 0.20 on the N-Gain scale (Table 7). Partial η² expresses the effect relative to the effect plus residual variance, not the share of total variance, and it is very high here because the variation within cells is very small.

Learning style also had a significant main effect, $F(2, 92) = 85.40$, $p < 0.001$, partial $\eta^2 = 0.650$, 95% CI [0.590, 0.733]. Because the interaction was significant, this main effect is interpreted through the simple effects in Table 9 rather than on its own.

The learning method × learning style interaction was significant, $F(2, 92) = 28.48$, $p < 0.001$, partial $\eta^2 = 0.414$, 95% CI [0.310, 0.546], which means that the GASING − direct instruction difference was not the same in the three learning-style groups. In absolute

terms the interaction is small relative to the method effect: its sum of squares is about 1% of that of the method (0.0112 vs. 0.9829).

4. Interaction Effect

A significant interaction does not show where the difference lies. The GASING − direct instruction difference was therefore estimated within each learning style (Table 7), the differences between these differences were tested (Table 8), and learning styles were compared within each method (Table 9). All contrasts use HC3 standard errors and Bonferroni adjustment for the three comparisons in each family.

Table 7. GASING − DI Difference within Each Learning Style

Learning Style	Mean Difference (GASING − DI)	Std. Error (HC3)	95% CI (Bonferroni)	Sig. (Bonferroni)	Hedges' g [95% CI]
Visual	0.177	0.005	[0.164, 0.190]	< 0.001	11.79 [8.87, 14.72]
Auditory	0.204	0.004	[0.194, 0.214]	< 0.001	16.44 [12.64, 20.24]
Kinesthetic	0.233	0.005	[0.220, 0.246]	< 0.001	18.28 [12.82, 23.74]

GASING exceeded DI in every learning-style group (all adjusted $p < 0.001$; Welch t tests gave the same conclusion). The advantage was 0.177 for visual, 0.204 for auditory, and 0.233 for kinesthetic students. The Hedges' g values (11.8 to 18.3) are far larger than those usually found in educational research and mostly reflect the very small within-cell variability; the raw mean differences and their confidence intervals are the more reliable summary.

Table 8. Differences in the GASING Advantage between Learning Styles (Interaction Contrasts)

Contrast	Estimate	Std. Error (HC3)	95% CI (Bonferroni)	Sig. (Bonferroni)
Auditory − Visual	0.027	0.007	[0.011, 0.043]	< 0.001
Kinesthetic − Visual	0.056	0.007	[0.038, 0.074]	< 0.001
Kinesthetic − Auditory	0.029	0.007	[0.013, 0.045]	< 0.001

The GASING group advantage was larger for kinesthetic than for visual students by 0.056 [0.038, 0.074], larger for kinesthetic than for auditory students by 0.029 [0.013, 0.045], and larger for auditory than for visual students by 0.027 [0.011, 0.043]. The method effect therefore had the same direction in all three groups and differed in size, not in sign.

Table 9. Comparisons among Learning Styles within Each Learning Method

Group	Learning Style		Mean Difference (I−J)	Std. Error (HC3)	95% CI (Bonferroni)	Sig. (Bonferroni)
	I	J				
GASING	Visual	Auditory	0.020	0.003	[0.013, 0.028]	< 0.001
	Visual	Kinesthetic	-0.031	0.005	[-0.043, -0.020]	< 0.001
	Auditory	Kinesthetic	-0.052	0.005	[-0.064, -0.040]	< 0.001
DI	Visual	Auditory	0.047	0.006	[0.033, 0.062]	< 0.001
	Visual	Kinesthetic	0.025	0.006	[0.011, 0.039]	< 0.001
	Auditory	Kinesthetic	-0.023	0.004	[-0.033, -0.012]	< 0.001

Within the GASING group, kinesthetic students gained more than visual students (0.031) and auditory students (0.052), and visual students gained more than auditory students (0.020); all adjusted $p < 0.001$. Within the direct instruction group, visual students gained more than kinesthetic (0.025) and auditory students (0.047), and kinesthetic students gained more than auditory students (0.023); all adjusted $p < 0.001$.

Auditory students had the lowest mean N-Gain under both methods, so the interaction arises mainly from the reversal in the order of visual and kinesthetic students between the two methods: kinesthetic students ranked first under GASING, and visual students ranked first under direct instruction.

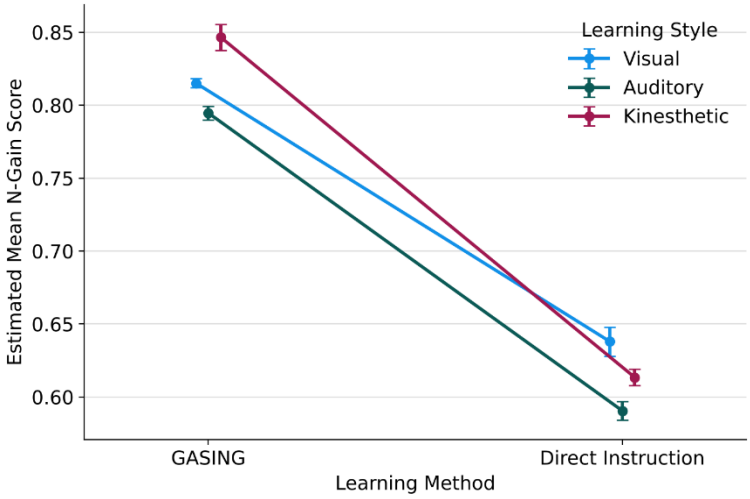


Figure 2. Interaction between Learning Method and Learning Style

Figure 2 shows the same pattern. The lines of all three learning styles fall from GASING group to DI group, the fall is steepest for kinesthetic students, and the lines of visual and kinesthetic students cross because their order reverses between the methods.

The non-parallel lines represent the interaction, but the distance between GASING group and DI group is large in every group. The main conclusion is therefore the consistent

advantage of GASING group; learning style modifies the size of this advantage only modestly.

Discussion

The analysis of the effect of implementing the GASING learning method on numeracy enhancement among Grade VII junior high school students, viewed from their learning style, indicates that the average numeracy enhancement of students in the GASING group is better than that of students in the Direct Instruction (DI) group. This is in line with earlier work on GASING and numeracy (Anwar, Kusumah, & Priatna, 2026). It also agrees with previous studies showing that the GASING learning method can improve basic arithmetic skills such as addition, multiplication, subtraction, and division (Armianti et al., 2016; Hendriana et al., 2019; Lestari & Hardini, 2022; Rumajar et al., 2024; Situmorang et al., 2024), as well as conceptual understanding and students' creativity (Pratiwi et al., 2021). Because the test emphasized procedures and arithmetic operations, which GASING also teaches directly, the result applies mainly to these aspects of numeracy; other components, such as mathematical communication and argumentation, were not measured.

Earlier work links learning styles to numeracy and mathematics performance (Munahefi et al., 2024; Yerizon et al., 2025). For example, Maquiling and Desabella (2025) reported that visual and kinesthetic learning styles were positively related to mathematics performance. The present study adds an estimate of how much the benefit of one specific teaching method differs across these groups. Whether learning styles matter can also depend on context and implementation (Mozaffari et al., 2020).

A plausible explanation lies in the sequence of GASING. The concrete stage lets students build the meaning of quantities by handling objects, the abstract stage connects these objects to symbols, and *mencongak* consolidates the operations into mental calculation (Surya, 2024). This order parallels the enactive–iconic–symbolic progression described by Bruner (1966) and the concrete–representational–abstract sequence reported to support mathematics learning (Kaya & Yildiz, 2024; Prosser & Bismarck, 2023; Ughi, 2020), and mental computation is associated with number sense (Lemonidis, 2016). Direct instruction, in which the teacher typically demonstrates procedures before students practice them, offers fewer opportunities to build this meaning before symbols are used. These mechanisms were not measured here and remain explanations to be tested.

The interaction shows that the size of the GASING advantage depended on learning style, although its direction did not: the advantage grew from visual (0.177) to auditory

(0.204) to kinesthetic students (0.233), and the kinesthetic − visual difference in advantage was 0.056 [0.038, 0.074], about 28% of the overall advantage of 0.20. A hands-on first stage may help kinesthetic students most, which fits the finding that kinesthetic and visual preferences are related to mathematics performance. An unexpected result is that auditory students gained the least under both methods even though GASING uses songs and singing. Songs may work as memory aids for all students rather than match an auditory preference, the questionnaire measures preference rather than ability, and the cells were small (n = 12 to 20), so this result needs replication before it is interpreted further. The interaction is also compatible with the idea that instruction should respond to student diversity, as in differentiated instruction (Tomlinson, 2014).

These results should not be read as support for matching instruction to learning styles. Reviews have found little evidence that teaching to a student's preferred style improves learning (Pashler et al., 2008), and this design cannot test matching because students were not assigned to styles. What the data show is moderation: students grouped by self-reported preference benefited to different degrees. The grouping may also stand in for other characteristics, such as prior knowledge, motivation, or school, which were not controlled. The contribution of the study is therefore an estimate that the benefit of GASING was large in all three groups and somewhat larger for kinesthetic students, not evidence for a learning-styles mechanism.

For teachers, this suggests that GASING need not be reserved for students with a particular learning style, because it outperformed direct instruction in all three groups. Because auditory students gained least under both methods, teachers could check whether verbal explanation accompanies the concrete and symbolic stages, but this suggestion has not been tested here.

CONCLUSION

A two-way linear model with HC3 inference showed that GASING produced higher numeracy gains than direct instruction. Learning style was also associated with N-Gain, and interacted with method. GASING learning method was superior in all three groups, with an advantage of 0.177 for visual, 0.204 for auditory, and 0.233 for kinesthetic students. Within GASING group, kinesthetic students gained most; within direct instruction, visual students gained most; and auditory students gained least under both methods. The interaction is therefore one of size, and of the order of visual and kinesthetic students, not of the direction of the method effect.

Several limitations apply. First, the design was quasi-experimental with intact classes in three schools; students were analyzed as independent, although they are nested in classes and schools, so standard errors may be too small and the method effect cannot be separated from school and teacher effects. Second, N-Gain varied very little within groups, which makes standardized effects very large and sensitive; the raw differences are the safer summary, and replication with a more discriminating instrument is needed. Third, the test had five items and emphasized procedures and arithmetic operations, which overlap with the focus of GASING learning method. Fourth, learning style was a self-reported preference classified by the highest section score, with only 12 students per method in the kinesthetic group, and the analysis of N-Gain does not adjust for pretest scores. Fifth, only short-term gains were measured, and the proposed mechanisms were not tested. Future studies should randomize at the class or school level, use mixed models that account for clustering, include a delayed posttest, and measure numeracy more broadly.

DECLARATIONS

Author Contribution : Author 1: Conceptualization, Writing - Original Draft, Formal Analysis, Editing and Visualization.
Author 2: Methodology, Validation and Supervision.
Author 3: Validation and Supervision.
Author 4: Writing - Review & Editing, Visualization

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