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The motivational impact of numeracy-based think pair share in elementary science education

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ABSTRACT

Purpose: to examine the effectiveness of numeracy-based think-pair-share (TPS) in improving grade V students' learning motivation in IPAS compared with conventional instruction.
Method: this study used a quasi-experimental design with 20 grade V students in experimental and control groups. Data were collected through pretest and posttest motivation questionnaires and analyzed using N-Gain.
Findings: showed that numeracy-based TPS improved students' learning motivation, with a mean increase of 21.39 points and an N-Gain of 0.68, compared with 10.12 points and an N-Gain of 0.32 in the control group. These findings suggest that numeracy-based TPS is a promising approach to enhancing motivation in elementary IPAS learning.
Implications: this study highlights the potential of numeracy-based TPS as an innovative instructional strategy to enhance student motivation through active participation, peer collaboration, and meaningful numeracy activities in elementary IPAS learning.
Originality: lies in integrating numeracy literacy with the think-pair-share (TPS) model to enhance students' learning motivation in elementary IPAS, an approach that remains limited in previous research.

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Introduction

Education is a fundamental determinant of human resource development and national competitiveness in responding to contemporary challenges (Sanga & Wangdra, 2023; Zulwiddi & Iswantir, 2023). At the elementary school level, education is expected not only to facilitate knowledge acquisition but also to develop students' critical thinking, problem-solving, and ability to apply knowledge in everyday contexts (Vieira & Vieira, 2016). In Indonesia, the Ilmu Pengetahuan Alam dan Sosial (IPAS), or Natural and Social Sciences, subject within the Merdeka Curriculum is designed to help students understand natural and social phenomena through observation, analysis, and the integration of knowledge from different contexts (Kemendikbudristek, 2022). Achieving

these objectives requires instructional approaches that encourage active participation and meaningful engagement (Smith et al., 2005). Learning motivation matters because it influences students' willingness to participate, sustain effort, and persevere when facing learning difficulties (Alrabai & Derakhshan, 2026; Dinh, 2026). Highly motivated students tend to show greater persistence, curiosity, and engagement, whereas less motivated students may become passive and lose interest in learning activities (C. C. Firdaus et al., 2020; Uno, 2016; Wang et al., 2026). Therefore, fostering learning motivation is important to improving the quality of elementary IPAS education, especially when students are expected to interpret information, investigate phenomena, and apply their knowledge to solve problems.

Despite its importance, learning IPAS at the elementary level can be challenging when students encounter content that requires interpreting numerical information, tables, graphs, and simple calculations. Such content requires students to connect scientific and social concepts with numerical representations, which may be difficult for those who have not yet developed adequate numeracy skills. These difficulties can potentially reduce students' confidence, participation, and willingness to engage with learning activities. Maharani et al. (2025) identified learning difficulties among elementary students in IPAS, highlighting the need to consider the factors that may hinder students' understanding of the subject. In this context, numeracy literacy is an important cross-curricular competence that enables students to understand, use, interpret, and apply numerical information and mathematical symbols in everyday situations and across subject areas (Han et al., 2017; Kemendikbud, 2020; Winata et al., 2021). Consequently, difficulties with numeracy-related tasks may be an important instructional concern, especially when learning activities require students to interpret data and use numerical reasoning to understand phenomena. Addressing this concern requires more than additional exercises; it also requires learning experiences that make numerical information accessible and encourage students to construct their understanding actively.

Preliminary observations in grade V at UPTD SDN Amparaan 1 Bangkalan, Indonesia, reflect the relevance of this issue. The observations indicated that 12 of 20 students (60%) showed low engagement during IPAS lessons, while only about 20% could correctly answer questions requiring data interpretation or simple calculations. An interview with the classroom teacher further indicated that the teacher generally delivered content involving numerical information through conventional instruction, without a structured strategy to develop students' numeracy skills progressively. These preliminary findings suggest that the learning challenges in this classroom involve both student engagement and the instructional support available for numeracy-related tasks. Teacher-centered instruction dominated by lecturing may limit opportunities for students to articulate their reasoning, compare interpretations, and build understanding through interaction (Gribiea, 2026; Huda & Ikhsan, 2024; Solihin et al., 2024). In contrast, cooperative learning emphasizes interaction, positive interdependence, and shared responsibility among students, creating opportunities for more active participation and collaborative knowledge construction (Johnson & Johnson, 2009; Slavin, 2015; Suprijono, 2015). This contrast indicates the need to investigate instructional approaches that integrate numeracy-oriented learning activities with structured peer interaction to address the motivational challenges observed in elementary IPAS classrooms.

A potentially suitable approach is think-pair-share (TPS), a cooperative learning model Lyman (1981) introduced to encourage student participation through three

sequential stages: Think, Pair, and Share. During the Think stage, students consider a question or problem independently; during the Pair stage, they discuss their ideas and reasoning with a partner; and during the Share stage, they share their conclusions with the wider class (D. F. Firdaus, 2026; Lyman, 1981; Pasaribu, 2025). This sequence allows time for individual thinking, peer-supported clarification, and structured participation in classroom discussion. The model is relevant to elementary education because it lets students formulate initial responses, discuss them with peers, and share their understanding publicly. The cooperative structure also aligns with the principles of positive interdependence and active participation emphasized in cooperative learning theory (Johnson & Johnson, 2009; Nguyen & Oanh, 2025; Slavin, 2015). When applied to numeracy-related IPAS content, TPS may provide a structured setting in which students interpret numerical information independently, compare their reasoning with a partner, and explain their findings to others. Such activities may help make learning more participatory and give students greater opportunities to engage with challenging content. Nevertheless, the motivational benefits of TPS when specifically integrated with numeracy literacy in elementary IPAS learning require further empirical examination.

Previous studies provide an initial empirical basis for investigating this approach. Kamil et al. (2021) reported the effects of cooperative TPS on motivation and learning outcomes among grade VI students, while Mahendra (2021) examined TPS supported by instructional videos as an approach to improving the motivation of grade IV students. Zain & Ahmad (2021) also investigated the effects of TPS on motivation and mathematical communication skills among elementary school students. Beyond cooperative learning, Erlia & Kurniawati (2024) discussed numeracy literacy activities to improve elementary students' learning motivation, while Septianthari et al. (2023) examined numeracy literacy, achievement motivation, and self-concept in relation to mathematics learning outcomes. Halawa et al. (2025) further support the importance of motivation in IPAS, reporting that learning motivation contributed 17.6% to the learning achievement of grade V students. Collectively, these studies indicate that TPS, numeracy-related activities, and learning motivation are relevant areas of educational research. However, the cited literature addresses these elements in different combinations, subject areas, and learning contexts. Evidence specifically examining how to integrate numeracy literacy into the TPS sequence to support motivation in elementary IPAS learning remains limited. This gap supports investigating a combined approach rather than assuming that the separate benefits reported for TPS and numeracy literacy will necessarily occur when the two are integrated.

To address this gap, the present study proposes a numeracy-based think-pair-share approach, in which numeracy activities are deliberately incorporated into all three TPS stages of grade V IPAS instruction. During Think, students independently examine numerical information, such as figures, tables, graphs, or simple data representations, and develop an initial interpretation. During Pair, they compare answers, discuss alternative interpretations, and clarify their reasoning with a partner. During Share, they communicate their findings and explain the reasoning underlying their conclusions to the class. The proposed novelty lies in integrating numeracy literacy into the full TPS sequence in the context of elementary IPAS learning, rather than treating numeracy exercises and cooperative learning as separate instructional activities. The theoretical rationale combines the principles of cooperative learning, which emphasize interaction, active participation, and positive interdependence (Johnson & Johnson, 2009; Slavin, 2015), with the understanding of numeracy literacy as the ability to apply numerical knowledge to interpret information and solve problems across contexts (Han et al.,

2017; Kemendikbud, 2020). This integration is expected to provide students with opportunities to engage with numerical information through individual reasoning, peer discussion, and classroom communication. The novelty is therefore framed as a context-specific instructional integration that warrants empirical testing, rather than as an assumption that the approach is necessarily more effective than existing methods.

Accordingly, this study has three objectives: (1) to describe grade V students' IPAS learning motivation before the implementation of numeracy-based TPS, (2) to describe their IPAS learning motivation after the implementation of the model, and (3) to analyze the effectiveness of numeracy-based TPS compared with conventional instruction. These objectives are important because they address both students' motivational conditions before and after the intervention and the comparative value of the proposed instructional approach. Learning motivation relates to students' persistence, engagement, and learning experiences (C. C. Firdaus et al., 2020; Uno, 2016), and its link to learning achievement has also been examined in the context of grade V IPAS (Halawa et al., 2025). By examining motivational changes and comparing outcomes between instructional conditions, the study seeks to establish whether integrating numeracy activities into TPS offers a meaningful advantage over conventional instruction. This comparison matters because improvements observed after an intervention alone do not show that the intervention is more effective than an alternative approach. Accordingly, the strength of the conclusions will depend on the research design, the quality of the motivation measures, and the appropriateness of the statistical comparisons.

This study is expected to contribute to elementary education at theoretical, pedagogical, and practical levels. Theoretically, it may extend research on cooperative learning by examining how integrating numeracy literacy into TPS relates to students' motivation in IPAS, thereby linking research on instructional models to research on cross-curricular numeracy development. Pedagogically, the findings may clarify whether combining individual reasoning, peer discussion, and classroom sharing around numerical information provides motivational benefits beyond those associated with conventional instruction. Practically, the study may offer elementary teachers an evidence-informed alternative for designing more interactive, contextualized, and inclusive IPAS lessons, particularly when teaching topics involving data interpretation and simple calculations. It may also inform schools' efforts to strengthen numeracy across subject areas rather than treating it exclusively as a mathematics competency. More broadly, the findings are expected to support instructional decision-making by identifying the potential and limitations of numeracy-based TPS as a strategy for improving students' learning experiences. By focusing on motivation in elementary IPAS education, this study aims to lay the groundwork for further research on integrating cooperative learning and numeracy literacy across grade levels, subject areas, and educational settings.

Method

This study used a quantitative, quasi-experimental design with a nonequivalent control group (Sugiyono, 2019). This design was selected because the research involved existing classroom groups that could not be randomly assigned to experimental conditions. The study was conducted during the second semester of the 2025/2026 academic year at UPTD SDN Amparaan 1 Bangkalan, Madura, Indonesia. The research design included two groups: an experimental group that received numeracy-based think-pair-share (TPS) instruction and a control group that received conventional

instruction. Both groups completed a pretest before the intervention and a posttest after the instructional period to measure changes in students' learning motivation. The pretest and posttest measurements enabled the researchers to examine within-group changes and compare motivational outcomes between the two instructional conditions.

The study population included 20 grade V students. The researchers used purposive sampling to select the participating classes and assign them to the experimental and control conditions based on the existing classroom arrangement. Class V-A, comprising 10 students, served as the experimental group, while Class V-B, also comprising 10 students, served as the control group. Because the groups were not formed through individual random assignment, their initial comparability was examined using pretest scores and preliminary statistical analyses. The normality of the data was assessed using the Shapiro–Wilk (1965) test, while the homogeneity of variances was examined using Levene's (1960) test. These procedures assessed whether the data were suitable for subsequent parametric analyses. However, we also considered the initial pretest scores and the limitations of the small sample size and nonequivalent group design when interpreting group comparability.

The experimental group received instruction through numeracy-based TPS, which integrated numeracy activities into the three stages of the cooperative learning model. During the Think stage, students independently read, examined, and interpreted numerical information presented in data sets, tables, or graphs related to the IPAS learning materials. During the Pair stage, students worked with a partner to calculate, compare, and analyze the information, discuss alternative interpretations, and formulate conclusions. During the Share stage, each pair communicated its analytical results and reasoning to the class. This sequence provided opportunities for individual thinking, collaborative problem-solving, and communicating ideas. The selected IPAS content included quantitative information related to natural features, social and cultural diversity, changes in states of matter, and natural resource potential. The control group received instruction through conventional teaching, primarily involving teacher explanations and question-and-answer activities. During the intervention, an observation checklist monitored implementation of the TPS instructional stages and assessed the extent to which the planned learning activities were carried out.

Students' learning motivation was measured using a five-point Likert-scale questionnaire developed in line with the principles of psychological scale construction described by Azwar (2012). The questionnaire was based on six learning motivation indicators identified by Uno (2016): (1) the desire and aspiration to succeed, (2) learning needs and drives, (3) future hopes and aspirations, (4) recognition and appreciation in learning, (5) engaging learning activities, and (6) a conducive learning environment. The questionnaire included both favorable and unfavorable statements to capture students' responses to different aspects of learning motivation. Content validity was examined through expert judgment, while item validity was assessed using the pearson product–moment correlation. Internal consistency reliability was evaluated using Cronbach's Alpha (Cronbach, 1951), yielding a coefficient of 0.87, indicating high internal consistency. The questionnaire was administered to both groups before and after the intervention. The resulting pretest and posttest scores served as the primary data for evaluating students' learning motivation. The observation checklist provided complementary information on implementing the experimental instructional model.

The data were analyzed using IBM SPSS Statistics version 23. Descriptive statistics were first calculated to summarize students' learning motivation scores before and after the intervention in both groups. The Shapiro–Wilk (1965) test was used to

assess the normality of the score distributions, and Levene's (1960) test was applied to examine the homogeneity of variances. Changes in motivation were also evaluated using the normalized gain (N-Gain) method proposed by Hake (1998), calculated as the difference between posttest and pretest scores divided by the maximum possible score minus the pretest score. N-Gain values were interpreted using the following categories: high ($g \geq 0.70$), medium ($0.30 \leq g < 0.70$), and low ($g < 0.30$). The analyses aimed to assess whether numeracy-based TPS was associated with greater improvement in students' learning motivation than conventional instruction.

Results and discussion

Descriptive analysis of students' IPAS learning motivation

The descriptive analysis examined students' learning motivation before and after the instructional intervention in both the experimental and control groups. As shown in Table 1, the experimental group had a pretest mean score of 68.25 (SD = 5.12), while the control group had a mean score of 67.81 (SD = 5.47). The initial difference between the groups was only 0.44 points, indicating that their average motivation scores were similar before the intervention. Following the instructional period, the experimental group's mean score increased to 89.64 (SD = 4.38), whereas the control group's mean score increased to 77.93 (SD = 5.02). These results indicate greater improvement in motivation among students who received numeracy-based think-pair-share (TPS) instruction.

Table 1 descriptive statistics of students' IPAS learning motivation

Group	Test	N	Minimum	Maximum	Mean	SD
Experimental	Pretest	10	58	78	68.25	5.12
Experimental	Posttest	10	80	98	89.64	4.38
Control	Pretest	10	56	79	67.81	5.47
Control	Posttest	10	68	88	77.93	5.02

Source: primary data, processed.

As shown in Table 1, the experimental group experienced a mean increase of 21.39 points, compared with 10.12 points in the control group. The difference between these mean increases was 11.27 points, favoring the experimental group. The experimental group's standard deviation also decreased from 5.12 to 4.38, suggesting somewhat less variation in posttest motivation scores. However, this change in dispersion alone does not show that every student improved similarly. The posttest minimum and maximum scores indicate that the experimental group scored between 80 and 98, while the control group scored between 68 and 88. Overall, the descriptive findings favor numeracy-based TPS, although inferential analysis is required to determine whether the observed difference between groups is statistically significant.

Assumption testing and normalized gain analysis

Before conducting the parametric analysis, the distributions of the pretest and posttest scores were examined using the Shapiro–Wilk (1965) test. The significance values were 0.362 for the experimental pretest, 0.251 for the experimental posttest, 0.317 for the control pretest, and 0.198 for the control posttest. All values exceeded the 0.05 significance threshold, indicating that the tests did not provide sufficient evidence to reject the assumption of normality. Levene's (1960) test also indicated homogeneous variances for the pretest scores ($p = 0.645$) and posttest scores ($p = 0.667$). These

findings supported using parametric procedures for subsequent comparisons, subject to the limitations of the small sample and the assumptions of the selected statistical tests. To complement the descriptive comparison, normalized gain (N-Gain) was used to characterize relative improvement in motivation scores in each group. Table 2 presents the mean score increases and corresponding N-Gain values.

Table 2 mean score improvement and normalized gain

Group	Mean score increase	N-Gain	Category
Experimental	21.39	0.68	Medium
Control	10.12	0.32	Medium

Source: primary data, processed.

As reported in Table 2, both groups demonstrated medium N-Gain values, but the experimental group achieved a higher value (0.68) than the control group (0.32). The experimental group's N-Gain was close to the high-category threshold, although it remained in the medium category under the specified classification. The difference indicates that the experimental group achieved greater normalized improvement relative to its available score range. Nevertheless, interpret N-Gain as a supplementary descriptive indicator rather than independent proof of treatment effectiveness, particularly because it was originally developed to assess learning gains, and applying it to motivation questionnaire scores requires appropriate justification.

The motivational value of numeracy-based think pair share

The findings suggest that integrating numeracy activities into TPS may provide students with a more supportive learning experience than conventional instruction. One plausible explanation is that the intervention combines two complementary elements: numeracy tasks provide meaningful cognitive challenges, while the TPS structure organizes how students approach, discuss, and communicate their responses. Rather than receiving numerical information solely through teacher explanations, students are encouraged to engage directly with it, test their interpretations, and explain their reasoning. This combination may make IPAS learning more participatory and give students a more active role in the learning process. The interpretation is consistent with cooperative learning theory, which emphasizes positive interdependence and interaction as important features of collaborative learning (Johnson & Johnson, 2009; Slavin, 2015). However, because the study implemented numeracy integration and the TPS model together, the present design cannot determine each component's independent contribution to the observed motivational difference.

The results are also consistent with previous research reporting motivational benefits associated with TPS. Kamil et al. (2021) examined TPS in grade VI and reported effects on students' motivation and learning outcomes, while Mahendra (2021) investigated TPS supported by instructional videos as a means of improving motivation among grade IV students. Zain & Ahmad (2021) further demonstrated TPS's relevance to elementary education by examining its relationship with motivation and mathematical communication skills. The present study extends this line of research by applying TPS to IPAS content involving numerical information. Its contribution lies not simply in using TPS in another classroom context, but in structuring the model around numeracy-related tasks that require students to interpret data, compare quantitative information, and communicate conclusions. This distinction offers a pedagogical explanation for why TPS may be particularly relevant when students need to engage with numerical

representations in a subject that integrates scientific and social phenomena (Acebes & Taber, 2026; Peña et al., 2025; Putri & Zulherman, 2026).

The think stage: individual reasoning and readiness to participate

The Think stage may support motivation by giving students time to process information independently before they are expected to respond publicly. According to the classroom observations described in the study, some students who initially appeared hesitant became more prepared to answer questions and express their ideas after being given approximately three to five minutes to think. This observation plausibly explains how structured individual preparation may support students' willingness to participate. Students can first interpret a table, graph, or numerical problem without the immediate pressure of speaking in front of the class. Preparing an initial response may also help them identify what they understand and what needs further clarification.

This process relates to Uno's (2016) indicators of learning motivation, particularly the desire to succeed and the drive to engage in learning. When students have sufficient time to formulate their own answers, participation may become more manageable because they do not have to respond spontaneously. The stage may also encourage greater responsibility for learning by setting the expectation that each student will contribute an initial idea before receiving partner assistance. Nevertheless, treat classroom observations as qualitative evidence to interpret the quantitative results, rather than as independent proof that the Think stage increased motivation. Because the study measured motivation with an overall questionnaire, it cannot determine which specific indicator changed most unless it analyzes the corresponding subscale scores separately.

The pair stage: peer support and shared problem-solving

The Pair stage may support motivation by creating a more manageable social setting for discussing difficult material. Working with one partner lets students compare answers, ask questions, and clarify misunderstandings before presenting their conclusions to the class. In numeracy-based IPAS activities, students may need to interpret the same data, compare numerical values, identify patterns, or explain the conclusions they draw from a graph. These activities require more than a correct answer; they also require students to explain how they reached it and consider whether another interpretation is reasonable. Peer discussion can therefore create opportunities for students to become more actively involved in the learning process.

This interpretation aligns with the cooperative learning principles described by Johnson & Johnson (2009) and Slavin (2015), particularly positive interdependence and interaction among learners. When a task requires both partners to contribute, students have a reason to explain their thinking and listen to others' reasoning. The activity may also reduce the immediate social pressure associated with addressing the whole class, especially for students who are uncertain about their numerical reasoning (Peña et al., 2025; Zhang et al., 2026). In relation to Uno's (2016) framework, such experiences may support students' learning needs and drives by making challenging tasks more approachable and by providing immediate opportunities for clarification. However, peer interaction does not automatically ensure equal participation or accurate understanding. The quality of the discussion depends on task design, the balance of contributions between partners, and the teacher's guidance. Future studies could

examine whether motivational benefits differ by students' initial numeracy skills or by the composition of their pairs.

The share stage: recognition, communication, and classroom climate

The Share stage extends individual and paired reasoning into whole-class communication. Students present their findings and explain the reasoning behind their interpretations, while the teacher and classmates respond to their contributions. Classroom observations show that teacher appreciation through verbal praise, expressions of thanks, and applause accompanied students' presentations. Such responses may help create a classroom environment where students see their contributions as valued and are more willing to participate in subsequent activities. This is especially relevant when students present numerical interpretations that may be unfamiliar or difficult.

This process aligns with several indicators in Uno's (2016) motivation framework, particularly appreciation in learning, engagement in learning activities, and a conducive learning environment. Recognition may reinforce students' willingness to contribute, while opportunities to communicate findings can give learning tasks a clearer social purpose. The Share stage also links numeracy and communication because students must explain what the data represent and justify the conclusions they draw. This interpretation is compatible with Zain & Ahmad (2021) investigation of TPS in relation to motivation and mathematical communication skills. However, the present study did not isolate the effect of teacher praise or measure classroom psychological safety as a separate variable. These elements should therefore be understood as plausible mechanisms that may help explain the overall pattern, rather than as independently verified mediators of motivational change.

Numeracy literacy as a meaningful context for IPAS learning

Integrating numeracy literacy is a central feature that distinguishes the intervention from the conventional instruction used in the control group. Numeracy activities let students work with quantitative information in the context of the subject being studied, rather than treating numerical reasoning as an isolated mathematical exercise. For example, data on rainfall, plant growth, temperature, population, or natural resources can help students identify patterns, compare values, and develop evidence-based explanations. Such activities can make the relevance of numerical information more apparent by connecting it with phenomena that students can observe or encounter in everyday life.

This interpretation is consistent with Han et al. (2017); Kemendikbud (2020); and Winata et al. (2021), who situate numeracy literacy within the broader ability to use and interpret numerical information across contexts. It also aligns with Erlia & Kurniawati (2024), who discussed numeracy literacy activities as an approach to supporting elementary students' learning motivation. Whereas Erlia & Kurniawati (2024) focused on numeracy-related activities as a motivational strategy, the present study combines such activities with a structured cooperative learning sequence. Numeracy provides the content and cognitive challenge, while TPS provides a process through which students can explore the information, receive peer support, and communicate their interpretations. This complementary relationship plausibly explains the motivational advantage observed in the experimental group.

The potential contribution of numeracy integration should nevertheless be distinguished from an assumption that numeracy activities inherently increase

motivation (Bingol & Ozyaprak, 2025). Numerical tasks may also discourage students if they are too difficult, disconnected from students' prior knowledge, or insufficiently supported (Fryer & Shum, 2025). The motivational value of numeracy-based TPS therefore likely depends on task appropriateness, clear instructions, available peer support, and the relevance of the data to the IPAS concepts being taught. The present findings support further investigation of this integrated approach. However, they do not establish whether TPS, numeracy content, teacher facilitation, or interactions among these components account for the observed difference.

Interpreting the control group's improvement and the comparative findings

The increase in motivation observed in the control group indicates that conventional instruction also led to improved posttest scores. This change may reflect several influences, including routine classroom participation, familiarity with the subject matter, teacher interaction, or other experiences occurring during the instructional period. In experimental research, maturation and historical influences may explain changes over time. However, the present data do not establish which, if any, of these factors contributed to the control group's improvement. The experimental group's larger descriptive increase suggests that the intervention may offer additional motivational benefits beyond those associated with the learning experiences common to both groups. However, because the study used intact classes rather than individually randomized groups, differences in classroom dynamics, teacher practices, or other unmeasured characteristics cannot be ruled out as alternative explanations.

The comparative pattern broadly aligns with Kamil et al. (2021) and Mahendra (2021) on TPS and student motivation, as well as Erlia & Kurniawati (2024) on numeracy literacy activities. It also complements Zain & Ahmad (2021) work on TPS and mathematical communication by showing the relevance of structured peer interaction to learning activities involving numerical information. Consistent with Halawa et al. (2025), who reported that motivation contributed to grade V IPAS achievement, the present study treats motivation as an outcome of an instructional intervention rather than examining its contribution to achievement. This distinction matters: the findings do not show that the observed motivational improvement necessarily leads to higher academic achievement, although that relationship warrants further investigation.

Methodologically, the small sample of 20 students limits the precision and generalizability of the estimates. In addition, similar pretest means are encouraging but do not, by themselves, establish equivalence between the groups on all relevant characteristics. The posttest comparison should therefore be interpreted alongside the initial scores and the study's nonequivalent group design. The reported independent-samples t-statistic must also be reconciled with the descriptive statistics before presenting a definitive inferential conclusion. Once verified, reporting the exact degrees of freedom, the precise p-value, and an effect size with a confidence interval would provide a more complete assessment of the magnitude and uncertainty of the group difference.

Conclusions

This study indicates that numeracy-based think-pair-share (TPS) can improve grade V students' motivation to learn IPAS compared with conventional instruction. The experimental group's mean motivation score increased from 68.25 to 89.64, representing an improvement of 21.39 points, whereas the control group's mean score increased from 67.81 to 77.93, representing an improvement of 10.12 points. The

normalized gain values also favored the experimental group (0.68) compared with the control group (0.32). These findings suggest that integrating numeracy activities into the Think, Pair, and Share stages may create a more engaging learning experience by encouraging independent reasoning, peer collaboration, and idea communication. Therefore, the findings provide promising evidence of the potential motivational benefits of numeracy-based TPS, but the strength of the comparative conclusion depends on verified statistical results.

The study contributes to elementary education research by connecting cooperative learning with cross-curricular numeracy development in the context of IPAS. Practically, teachers may incorporate well-designed tables, graphs, and numerical problems into structured peer-learning activities to encourage participation and make learning more meaningful. Nevertheless, interpret the findings with several limitations in mind. The study included only 20 students from two existing classroom groups at one elementary school, limiting the results' generalizability. The nonequivalent control group design also leaves the possibility that pre-existing differences between classes or other contextual factors influenced the outcomes. Furthermore, the study examined overall motivation scores and did not establish which specific motivation indicators contributed most to the observed improvement. Combining TPS and numeracy activities also prevents researchers from determining the independent effects of each component.

Future research should use larger, more diverse samples across multiple elementary schools to test whether the findings replicate in different educational settings. Researchers should consider stronger procedures for controlling initial group differences, longer intervention periods, and follow-up measurements to determine whether motivational improvements are sustained over time. Further studies could also analyze individual motivation indicators and combine questionnaire data with systematic classroom observations, interviews, and measures of numeracy performance. In addition, comparing TPS alone, numeracy-based activities alone, and numeracy-based TPS would help identify each component's contribution and determine whether integrating them provides additional benefits. These directions would strengthen the empirical basis for understanding how numeracy-based cooperative learning can support motivation and improve the quality of elementary IPAS instruction.

References

Acebes, E. I., & Taber, K. S. (2026). Exploring science teachers' beliefs and epistemic knowledge of scientific explanation. *Disciplinary and Interdisciplinary Science Education Research*, *8*(1), 14. https://doi.org/10.1186/s43031-026-00162-2

Alrabai, F., & Derakhshan, A. (2026). L2 grit in multimodal generative AI-Enhanced classes: unveiling the role of DeepSeek-V3 in shaping English learners' passion and perseverance. *Innovation in Language Learning and Teaching*, 1–22. https://doi.org/10.1080/17501229.2026.2715641

Azwar, S. (2012). *Penyusunan skala psikologi*. Pustaka Pelajar.

Bingol, B., & Ozyaprak, M. (2025). Enhancing Higher Education: Differentiating the Curriculum and Instruction to Foster Mathematical Creativity and Motivation. *The Journal of Creative Behavior*, *59*(2). https://doi.org/10.1002/jocb.70000

Cronbach, L. J. (1951). Coefficient Alpha and the Internal Structure of Tests. *Psychometrika*, *16*(3), 297–334. https://doi.org/10.1007/BF02310555

Dinh, C. T. (2026). MOOCs for EFL learners: Challenges, motivation, and engagement through the lens of expectancy-value and socio-cognitive theories. *Research and Practice in Technology Enhanced Learning*, *21*, 048.

https://doi.org/10.58459/rptel.2026.21048

Erlia, S., & Kurniawati, K. (2024). Aktivitas Literasi Numerasi Sebagai Upaya Untuk Meningkatan Motivasi Belajar Siswa di Tingkat Sekolah Dasar. *Prosiding Seminar Nasional Pendidikan*. https://prosiding.unma.ac.id/index.php/semnasfkip/article/view/1285

Firdaus, C. C., Mauludyana, B. G., & Purwanti, K. N. (2020). Faktor-faktor yang Mempengaruhi Motivasi Belajar di SD Negeri Curug Kulon 2 Kabupaten Tangerang. *PENSA: Jurnal Pendidikan Dan Ilmu Sosial*, *2*(1), 43–52. https://ejournal.ipn.ac.id/index.php/pensa/article/view/774

Firdaus, D. F. (2026). Implementing Think-Pair-Share to Promote Active Participation in University English Language Learning. *Education and Social Humanities Conference (ESHCo)*, 795–806. https://conferences.uinsgd.ac.id/index.php/gdcs/article/view/3436

Fryer, L. K., & Shum, A. (2025). Math task experiences and motivation to learn more: How prior knowledge and interest interact with Task-Interest & Task-Difficulty perceptions and feed a desire to reengage. *British Educational Research Journal*, *51*(1), 49–72. https://doi.org/10.1002/berj.4057

Gribiea, A. M. (2026). From traditional teaching to argumentation-based instruction: A student-centered approach in mathematics education. *Asian Journal for Mathematics Education*, *5*(3), 366–390. https://doi.org/10.1177/27527263261467208

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, *66*(1), 64–74. https://doi.org/10.1119/1.18809

Halawa, A., Rosdianto, H., & Oktavia, W. (2025). Pengaruh Motivasi Belajar terhadap Prestasi Belajar pada Mata Pelajaran IPAS Siswa Kelas V SDS Torsina III Singkawang Tahun Ajaran 2024/2025. *Jurnal Papeda: Jurnal Publikasi Pendidikan Dasar*, *7*(2), 171–179. https://doi.org/10.36232/jurnalpendidikandasar.v7i2.1156

Han, S., Capraro, R., & Capraro, M. M. (2017). *Materi pendukung literasi numerasi*. Direktorat Jenderal Pendidikan Dasar dan Menengah, Kementerian Pendidikan dan Kebudayaan.

Huda, N., & Ikhsan, J. (2024). *Menggugat metode ceramah dalam pendidikan: Meluruskan fitnah mengusulkan paradigma baru*. Jejak Publisher.

Johnson, D. W., & Johnson, R. T. (2009). An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning. *Educational Researcher*, *38*(5), 365–379. https://doi.org/10.3102/0013189X09339057

Kamil, V. R., Arief, D., Miaz, Y., & Rifma, R. (2021). Pengaruh Penggunaan Model Pembelajaran Kooperatif Tipe Think Pair Share terhadap Motivasi dan Hasil Belajar Belajar Siswa Kelas VI. *Jurnal Basicedu*, *5*(6), 6025–6033. https://doi.org/10.31004/basicedu.v5i6.1744

Kemendikbud. (2020). *AKM dan implikasinya pada pembelajaran*. Pusat Asesmen dan Pembelajaran, Kementerian Pendidikan dan Kebudayaan.

Kemendikbudristek. (2022). *Capaian pembelajaran mata pelajaran Ilmu Pengetahuan Alam dan Sosial (IPAS) Fase A–Fase C untuk SD/MI/Program Paket A*. Badan Standar, Kurikulum, dan Asesmen Pendidikan, Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi.

Levene, H. (1960). *Robust Tests for Equality of Variances. In Contributions to Probability and Statistics: Essays in Honor of Harold Hotelling* (I. Olkin, S. G. Ghurye, W.

Hoeffding, W. G. Madow, & H. B. Mann (eds.)). Stanford University Press.

Lyman, F. (1981). *The responsive classroom discussion: The inclusion of all students*. Mainstreaming digest. College Park: University of Maryland College of Education.

Maharani, P., Fatmawati, R. A., & Setyowati, D. (2025). Analisis Faktor Kesulitan Belajar Siswa Pada Mata Pelajaran Ipas Kelas Iv Sdn 41 Sungai Raya. *Jurnal Pendidikan UNIGA*, *19*(2), 167–183. https://doi.org/10.52434/jpu.v19i2.43000

Mahendra, K. G. (2021). Implementasi Model Pembelajaran Think Paire Share Berbantuan Video Pembelajaran untuk Meningkatkan Motivasi Belajar Siswa Kelas IV SD No. 6 Darmasaba. *Jurnal Penelitian Pendidikan*, *13*(1), 34–41. https://doi.org/10.21137/jpp.2021.13.1.5

Nguyen, T. N. T., & Oanh, D. T. K. (2025). Cooperative learning and its influences on student engagement. *Cogent Education*, *12*(1). https://doi.org/10.1080/2331186X.2025.2513414

Pasaribu, E. Y. (2025). Perbandingan Hasil Belajar Peserta Didik Melalui Metode Ceramah Dan Think Pair Share (TPS) Pada Materi Listrik Statis Di Kelas XII SMAN 14 Kota Jambi. *Seminar Nasional Teknologi Dan Multidisiplin Ilmu (SEMNASTEKMU)*. https://prosiding.stekom.ac.id/index.php/SEMNASTEKMU/article/view/275

Peña, R. C. T., González, D. P., Orozco, J. L. L., Ariza, E. A., & Vergara, D. (2025). Enhancing Numerical Thinking Through Problem Solving: A Teaching Experience for Third-Grade Mathematics. *Education Sciences*, *15*(6), 667. https://doi.org/10.3390/educsci15060667

Putri, A. D., & Zulherman, Z. (2026). The Effect of the Think-Pair-Share (TPS) Learning Model Assisted by PhET Simulation on Fifth-Grade Students' Learning Outcomes in Simple Machines. *Journal of Educational Sciences*, *10*(9), 633–647. https://doi.org/10.31258/jes.10.9.p.633-647

Sanga, L. D., & Wangdra, Y. (2023). Pendidikan Adalah Faktor Penentu Daya Saing Bangsa. *Prosiding Seminar Nasional Ilmu Sosial Dan Teknologi (SNISTEK)*, *5*, 84–90. https://doi.org/10.33884/psnistek.v5i.8067

Septianthari, N. M. F. D., Dantes, N., & Sariyasa, S. (2023). Determinasi Literasi Numerik, Motivasi Berprestasi, Dan Konsep Diri Terhadap Hasil Belajar Matematika. *Media Bina Ilmiah*, *17*(11), 2603–2612. http://binapatria.id/index.php/MBI/article/view/449

Shapiro, S. S., & Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). *Biometrika*, *52*(3–4), 591–611. https://doi.org/10.1093/biomet/52.3-4.591

Slavin, R. E. (2015). *Cooperative learning: Theory, research, and practice*. Allyn & Bacon.

Smith, K. A., Sheppard, S. D., Johnson, D. W., & Johnson, R. T. (2005). Pedagogies of Engagement: Classroom-Based Practices. *Journal of Engineering Education*, *94*(1), 87–101. https://doi.org/10.1002/j.2168-9830.2005.tb00831.x

Solihin, S., Ernawati, E., & Suroto, A. (2024). Meningkatkan Hasil Belajar Pendidikan Agama Islam melalui Pembelajaran Berbasis Ceramah Interaktif di SMP N 5 Bangko. *EduSpirit: Jurnal Pendidikan Kolaboratif*, *1*(3), 494–500. https://journal.makwafoundation.org/index.php/eduspirit/article/view/1200

Sugiyono, S. (2019). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta.

Suprijono, A. (2015). *Cooperative learning: Teori dan aplikasi PAIKEM*. Pustaka Pelajar.

Uno, H. B. (2016). *Teori motivasi dan pengukurannya: Analisis di bidang pendidikan*. Bumi Aksara.

Vieira, R. M., & Vieira, C. T. (2016). Fostering Scientific Literacy and Critical Thinking in

Elementary Science Education. *International Journal of Science and Mathematics Education*, *14*(4), 659–680. https://doi.org/10.1007/s10763-014-9605-2

Wang, L., Chen, X., Sun, L., & Chen, C. (2026). Why do students lose the joy of learning? Evidence from engagement, curiosity, and classroom experience. *Frontiers in Psychology*, *17*. https://doi.org/10.3389/fpsyg.2026.1776932

Winata, A., Widiyanti, I. S. R., & Cacik, S. (2021). Analisis Kemampuan Numerasi dalam Pengembangan Soal Asesmen Kemampuan Minimal pada Siswa Kelas XI SMA untuk Menyelesaikan Permasalahan Science. *Jurnal Educatio FKIP UNMA*, *7*(2), 498–508. https://doi.org/10.31949/educatio.v7i2.1090

Zain, B. P., & Ahmad, R. (2021). Pengaruh Model Kooperatif Tipe Think Pair Share terhadap Motivasi dan Kemampuan Komunikasi Matematis Siswa Sekolah Dasar. *Jurnal Basicedu*, *5*(5), 3668–3676. https://doi.org/10.31004/basicedu.v5i5.1408

Zhang, Q., Siraj, S. B., & Razak, R. B. A. (2026). Effects of AI chatbots on EFL students' critical thinking skills and intrinsic motivation in argumentative writing. *Innovation in Language Learning and Teaching*, *20*(5), 1200–1228. https://doi.org/10.1080/17501229.2025.2515111

Zulwiddi, N., & Iswantir, I. (2023). Manajemen Sumber Daya Manusia Dalam Meningkatkan Mutu Pendidikan. *AKSI: Jurnal Manajemen Pendidikan Islam*, *2*(1), 16–27. https://doi.org/10.37348/aksi.v2i1.356