Effect of Peer Learning Method on the Performance of Grade 7 Students in the Operation of Integers

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ABSTRACT

This study investigated the effect of Peer Learning Method on the performance of Grade 7 students in operations on integers. It specifically compared the pre-test and post-test performance of students who were taught through traditional instruction and those who were exposed to the Peer Learning Method enrolled in one of the public high schools in Negros Island Region during the school year 2025-2026. A quasi-experimental pretest–posttest control-group design was employed to compare the performance of Grade 7 students taught through traditional instruction and those exposed to the Peer Learning Method. Two intact classes were purposively selected based on accessibility and administrative considerations, after which the classes were randomly designated as either the experimental or control group through a coin toss. Results revealed that both groups demonstrated improvement following the intervention, with the controlled group showing an increase in performance in operations on integers, progressing from a nearly proficient level to a proficient level of achievement. The experimental group improved also from nearly proficient to highly proficient. Results revealed a significant difference between pre-test and post-test performance of the experimental group. Also, it indicated a significant difference between the post-test performance of the controlled and experimental groups. The findings indicate that students exposed to the Peer Learning Method demonstrated significantly higher posttest performance than those receiving traditional instruction in this study. However, the findings should be interpreted in light of the intact-class design, small sample size, and single-school implementation. It is recommended that teachers integrate peer learning strategies to enhance student achievement in mathematics.

Keywords: Peer Learning Method, Peer Learning, Traditional Instruction, Operations on Integers, Mathematics Performance.

INTRODUCTION

Grade 7 students often struggle with integers—addition, subtraction, multiplication, and division—due to misconceptions about negatives, as seen in performance levels around 41-62% competency in Philippine studies mirroring PISA trends where Filipino students scored low (353 vs. OECD 489) (Aguilar et al., 2024).

Peer tutoring is widely recognized for its positive impact on students' academic achievement, enhancing attitudes toward learning, critical thinking, problem-solving, communication, social skills, and academic skills (Barahona et al., 2023). Studies have demonstrated significant academic improvements in various subjects, including mathematics, particularly benefiting students with emotional and behavioral (Osei-Himah et al., 2022). Meta-analyses further support its effectiveness, with medium to significant gains in academic performance, averaging effect sizes around 0.75 (Zhang, 2023).

Peer learning, also known as peer tutoring or peer-assisted learning, is an educational strategy with a strong background in educational theory and practice. Its application in mathematics has been widely studied and has shown significant positive effects on student performance, especially for Grade 7 students struggling with integer operations (Making Sense of Integer Operations Through Peer Tutoring, 2025).

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This study aimed to determine the effect of peer learning method on the performance of Grade 7 students in operation of integers, addressing problems like low mastery (e.g., subtraction weaknesses) via quasi-experimental designs comparing peer vs. traditional groups.

METHODOLOGY

The study employed a quasi-experimental pretest–posttest control-group design to determine the effect of the Peer Learning Method on the performance of Grade 7 students in operations on integers. Two intact Grade 7 classes were purposively selected based on accessibility and administrative considerations. Because the participants were selected as existing classes rather than individually randomized, the study was classified as quasi-experimental. After the two classes had been selected, a coin toss was used to randomly designate one class as the experimental group and the other as the control group. Thus, randomization occurred at the class level rather than at the individual student level. The study was conducted in a public secondary school in the Negros Island Region during School Year 2025–2026. The participants consisted of 48 Grade 7 students, with 24 assigned to the experimental group and 24 to the control group. Two intact classes were purposively selected based on accessibility and administrative considerations. Baseline equivalence between the experimental and control groups was assessed using the students' pretest scores in operations on integers. Because the pretest measured the same learning competencies targeted by the intervention, it provided a more direct measure of the groups' initial mathematical performance. A Mann–Whitney U test was conducted to determine whether a statistically significant difference existed between the groups at baseline. The results showed that the experimental group obtained a pretest mean of 20.04 ($SD = 4.97$), whereas the control group obtained a pretest mean of 19.54 ($SD = 3.45$). The test indicated that there was no statistically significant difference between the two groups at baseline. This suggests that the two groups were statistically comparable in their initial performance in operations on integers before the intervention.

The study used (E-RUNT), a standardized assessment developed/issued by the Department of Education (DepEd). The instrument consisted of 40 items assessing students' ability to perform addition, subtraction, multiplication, and division involving integers. The instrument was considered appropriate for the present study because its content directly corresponded to the Grade 7 learning competencies on operations on integers addressed during the intervention. Evidence of the instrument's validity and reliability was based on its standardized development and prior use by the Department of Education. Therefore, the researchers did not conduct a separate validation procedure for the instrument for the present study. The same 40-item E-RUNT was administered as both the pretest and posttest to maintain consistency in measuring the targeted competencies. However, the repeated administration of the same instrument may have introduced a practice or familiarity effect, whereby students could have benefited from prior exposure to the test items. This possibility was considered in interpreting the posttest results. As a standardized instrument, separate validity and reliability testing was not conducted. Prior to the intervention, the researcher secured the necessary permissions from the concerned authorities, obtained parental consent and student assent, and administered the pretest under uniform testing conditions. The intervention was implemented for four weeks during regular Mathematics classes. The experimental group received instruction through the Peer Learning Method, which included structured peer tutoring, collaborative problem solving, guided discussions, tutor–tutee exchanges, and small-group activities. The same Mathematics teacher handled both the experimental and control groups. To minimize potential teacher-related differences, the same teacher covered the same competencies and learning content, followed comparable instructional schedules, and allotted equivalent instructional time to both groups. The teacher implemented the peer-learning procedures only with the experimental group while maintaining conventional teacher-centered instruction in the control group. To minimize contamination, the instructional procedures specific to the peer-learning intervention were implemented only during the designated experimental-group sessions.

The collected data were encoded and analyzed using statistical software. Mean and standard deviation were used to describe the pretest and posttest performance of the two groups. Performance was interpreted using the following ranges: 36–40, Highly Proficient; 30–35, Proficient; 20–29, Nearly Proficient; 10–19, Low Proficiency; and 0–9, Not Proficient. The Wilcoxon signed-rank test was employed to determine whether a significant difference existed between the pretest and posttest performance of the experimental group, while the Mann–Whitney U test was used to determine whether a significant difference existed between the posttest performance of the control and experimental groups. All inferential analyses were tested at the 0.05 level of significance.

RESULTS AND DISCUSSIONS

Level of Pre-test and Post-test Performance in Mathematics of Students Under the Controlled Group

Table 3. Level of Pre-test and Post-test Performance in Mathematics of Students Under the Controlled Group.

Controlled Group	N	Mean	SD	Interpretation
Pre-Test	24	19.54	3.45	Nearly Proficient
Post-Test	24	31.58	7.37	Proficient
Legend: (36-40)- Highly Proficient, (30-35)- Proficient, (20-29)- Nearly Proficient, (10-19)- Low Proficiency, (0-9)- Not Proficient				

Table 3 shows the level of pre-test and post-test performance in Mathematics of students under the controlled group, which was exposed to the traditional method of teaching about operations on integers. The results revealed that the pre-test scores of students are on a nearly proficient level and indicates that students' scores were relatively close to the average, showing consistent performance (M=19.54, SD = 3.45). This indicates that students had only a basic understanding of integer operations. After the implementation of the traditional teaching method, the post-test mean score increased to a proficient level and some students improved significantly while others showed moderate gains (M=31.58, SD = 7.37). This suggests that the conventional approach typically characterized by teacher-centered instruction, direct explanation, drills, and practice exercises was effective in enhancing students' performance to a certain extent.

The improvement observed in the control group indicates that traditional instruction was also associated with meaningful gains in students' performance in operations on integers. The increase from a pretest mean of 19.54 to a posttest mean of 31.58 represents a 12.04-point improvement. Therefore, the findings should not be interpreted as indicating that traditional instruction was ineffective. Rather, both instructional approaches were associated with improved student performance, although the peer-learning group demonstrated a greater observed gain. The inferential comparison of gain scores between the two groups provides the more appropriate basis for determining whether the improvement associated with peer learning was significantly greater than that associated with traditional instruction.

The result of this study is in consonance with the study of Hattie (2020) which states that direct instruction has a strong positive effect on student achievement, especially when teachers clearly demonstrate procedures and provide guided practice. This supports the improvement observed in the controlled group's post-test scores. Moreover, Woolfolk (2021) noted that practice and reinforcement remain essential components of learning mathematics, as they help learners internalize rules and procedures, which may explain the improved performance of the controlled group.

Level of Pre-test and Post-test Performance in Mathematics of Students Under the Experimental Group

Table 4. Level of Pre-test and Post-test Performance in Mathematics of Students Under the Experimental Group.

Experimental Group	N	Mean	SD	Interpretation
Pre-Test	24	20.04	4.97	Nearly Proficient
Post-Test	24	37.58	5.12	Highly Proficient
Legend: (36-40)- Highly Proficient, (30-35)- Proficient, (20-29)- Nearly Proficient, (10-19)- Low Proficiency, (0-9)- Not Proficient				

Table 4 shows the level of pre-test and post-test performance in Mathematics of students under the experimental group in mastering operations on integers. Prior to the intervention, the pre-test performance of students obtained a nearly proficient level and it shows moderate variability, meaning students' initial performance levels were somewhat consistent but still varied in their grasp of integer operations (M=20.04, SD = 4.97). This indicates that while students possessed some foundational understanding of integer operations, their skills were still developing and required further enhancement. After the implementation of peer learning, the post-test scores increased to a highly proficient and slightly higher, suggests that while most students improved under the peer learning method, the degree of improvement differed among individuals (M=37.58, SD = 5.12). Following the four-week intervention, the experimental group's mean score increased from 20.04 (SD = 4.97) at pretest to 37.58 (SD = 5.12) at posttest, representing a 17.54-point improvement. The significant within-group change indicates that students demonstrated substantial improvement following exposure to the peer-learning intervention. However, the within-group result alone does not establish that peer learning was responsible for the difference because students in the control group also demonstrated improvement. Therefore, the comparative analysis of gain scores between the two groups provides a stronger basis for evaluating the differential effect of the instructional approaches.

Peer learning, as an instructional approach, emphasizes collaboration, active engagement, and shared responsibility among learners. According to recent studies, this method promotes deeper understanding because students can explain concepts in their own language, ask questions freely, and receive immediate feedback from peers.

Several mechanisms may help explain the observed improvement associated with peer learning. First, peer explanation may encourage students to verbalize mathematical reasoning rather than merely reproduce procedures. Explaining why a particular operation is performed can promote cognitive elaboration and help learners reorganize their understanding of integer rules. Second, immediate peer feedback may allow misconceptions to be identified and corrected while students are actively solving problems. Third, repeated opportunities to discuss and justify solutions can strengthen procedural understanding and problem-solving strategies. Peer interaction may also reduce mathematics-related anxiety by creating a less intimidating environment in which students can ask questions and make corrections before presenting their ideas to the teacher or the entire class. These processes provide a possible explanation for why structured peer interaction may support learning in integer operations.

Research by Topping (2020) highlights that peer learning fosters cognitive elaboration, where students clarify and restructure their understanding through discussion, leading to improved academic achievement. Similarly, a study by Loes and Pascarella (2021) found that collaborative learning environments significantly enhance critical thinking and problem-solving skills, particularly in subjects like mathematics.

Difference between the Pre-Test and Post-Test Performance in Mathematics of Students Under the Experimental Group

Table 5. Difference between the Pre-Test and Post-Test Performance in Mathematics of Students Under the Experimental Group.

Experimental Group (Pre-Test)-Experimental Group (Post-Test)	Mean Rank	Test Statistics (r)	p-value	Decision for Ho	Interpretation
Negative Ranks	1.00	-4.261	<.001	Reject Ho	Significant
Positive Ranks	13.00				

Table 5 shows the difference between the pre-test and post-test performance in Mathematics of the experimental group exposed to peer learning in teaching operations on integers. The data were analyzed using the Wilcoxon Signed-Rank Test, a nonparametric statistical tool used to determine significant differences between two related samples.

The results revealed that the positive ranks (Mean Rank = 13.00) exceeded the negative ranks (Mean Rank = 1.00), indicating that most students achieved higher performance in the post-test compared to the pre-test. The computed test statistic is -4.261 and the p-value (< .001) is less than 0.05 which indicates that the null hypothesis is rejected. This means that there is a statistically significant difference between the pre-test and post-test performance of the experimental group. This implies that the use of peer learning significantly improved students' performance in operations on integers.

The significant improvement the experimental group can be associated to the effectiveness of peer learning as an instructional strategy. Peer learning encourages active participation, collaborative problem-solving, and knowledge sharing among students. According to Moliner and Alegre (2020), peer tutoring significantly enhances students' academic performance and reduces mathematics anxiety, thereby creating a more conducive learning environment. Furthermore, Pendon (2024) found that peer collaboration leads to improved attitudes toward mathematics, which in turn contributes to better academic outcomes.

Difference between the Post-Test Performance in Mathematics of Students Under the Controlled and Experimental Groups

Table 6. Difference between the Post-Test Performance in Mathematics of Students under the Controlled and Experimental Groups.

Group	Mean Rank	Test Statistics (U)	p-value	Decision for Ho	Interpretation
Controlled Group	16.83	104.000	<.001	Reject Ho	Significant
Experimental Group	32.17				

Table 6 shows the difference between the post- test performance in Mathematics of students under the controlled and experimental groups using the Mann–Whitney U Test, a nonparametric statistical tool used to determine significant differences between two independent groups.

The results show that the experimental group obtained a higher mean rank (32.17) compared to the controlled group (16.83). This indicates that students exposed to the peer-learning method generally achieved higher post-test scores in the operations on integers than those taught using the traditional method.

The computed test statistic is 104.000 and the p-value (< .001) is less than 0.05 which means that the null hypothesis is rejected. This means that there is a significant difference between the post-test performance in the operations on integers of the controlled and experimental group. The experimental group obtained a higher mean rank (32.17) than the control group (16.83), and the Mann–Whitney U test indicated a statistically significant difference in posttest performance, U = 104.000, p < .001. These results indicate that the students exposed to peer learning achieved higher posttest performance than those who received traditional instruction. However, because the groups consisted of intact classes and were not individually randomized, the finding should be interpreted as evidence of a difference associated with the instructional conditions in this study rather than definitive evidence that the instructional method alone caused the difference. The comparison of gain scores between the groups should provide additional evidence regarding the differential improvement associated with the two instructional approaches.

The result of this study is consonance with the study of Roseth et al. (2022) which states that cooperative and peer learning approaches were shown to produce higher academic gains in mathematics, particularly in middle school students. The study highlighted that structured peer interaction leads to improved conceptual understanding and retention. Moreover, Gillies (2021) found that collaborative and peer-assisted learning strategies significantly improve students' problem-solving skills and academic performance compared to traditional lecture-based instruction. The interaction among peers fosters critical thinking and increases motivation.

Limitations of The Study

This study has several limitations that should be considered when interpreting the findings. First, the study involved only 48 Grade 7 students from a single public secondary school, which limits the generalizability of the findings to other schools and student populations. Second, the participants were drawn from two intact classes that were purposively selected, and randomization occurred at the class level rather than at the individual level. Consequently, pre-existing differences between the classes cannot be completely ruled out despite the assessment of baseline equivalence.

Third, the four-week intervention period was relatively short. A longer implementation period may provide a more comprehensive assessment of the sustained effects of peer learning on mathematical performance. Fourth, the same 40-item E-RUNT was administered as both the pretest and posttest. Repeated exposure to the same assessment may have introduced a practice or familiarity effect that could have contributed to improvements in posttest performance.

Fifth, teacher-related factors may have influenced student outcomes, particularly if differences existed in instructional delivery, classroom management, or facilitation of the intervention. Finally, because the study was conducted in only one school and involved only two classes, the findings should be viewed as context-specific evidence rather than definitive evidence that peer learning is universally more effective than traditional instruction.

RECOMMENDATIONS

Future studies may address these limitations by involving larger samples drawn from multiple schools and districts to improve the generalizability of findings. Researchers may also employ randomized designs with a greater number of classes or clusters to reduce the influence of pre-existing group differences and strengthen causal inference. Longer intervention periods and delayed posttests are recommended to determine whether improvements associated with peer learning are sustained over time. Future researchers may likewise use parallel or equivalent forms of the assessment rather than administering the same test twice to reduce potential practice effects. In addition, studies may examine the effects of different peer-learning structures, including tutor selection procedures, role rotation, group size, and intervention fidelity, to identify which components contribute most strongly to students' mathematical learning.

CONCLUSIONS

Based on the findings of the study, the following conclusions were formulated:

Students in both the control and experimental groups demonstrated improvement in their performance in operations on integers following the four-week instructional period. The control group increased from a nearly proficient level at pretest to a proficient level at posttest, while the experimental group increased from a nearly proficient level to a highly proficient level.

The experimental group demonstrated a statistically significant improvement from pretest to posttest following exposure to the Peer Learning Method. The magnitude of the observed change also indicates substantial improvement in students' performance.

The experimental group obtained significantly higher posttest performance than the control group. The experimental group also demonstrated a greater observed mean gain than the control group.

The findings provide evidence that the Peer Learning Method was associated with higher student performance in operations on integers than traditional instruction under the conditions of the present study. However, this conclusion should be interpreted cautiously because the study involved two intact classes, a relatively small sample, and a single-school setting.

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