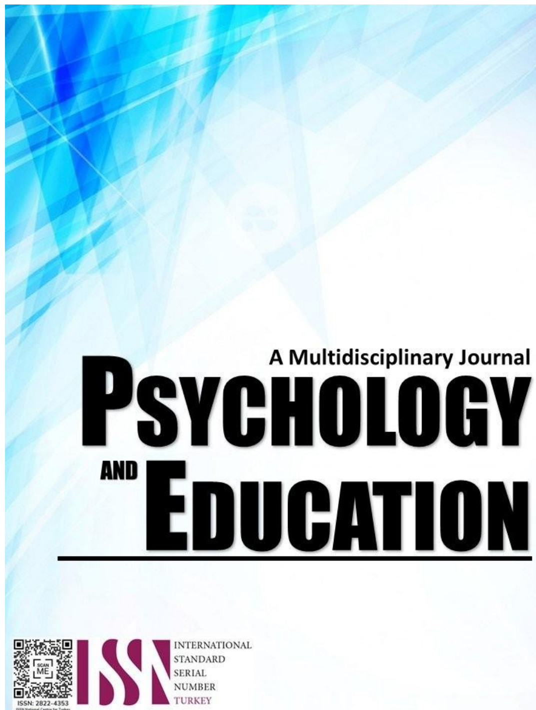
EFFECTIVENESS OF BUDDY SYSTEM AND EXPLICIT INSTRUCTION IN IMPROVING GRADE 9 STUDENTS' MATHEMATICS ACHIEVEMENT



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Research Article

Effectiveness of Buddy System and Explicit Instruction in Improving Grade 9 Students' Mathematics Achievement

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Abstract

This study investigated the effectiveness of the Buddy System combined with explicit instruction in enhancing the mathematics performance of Grade 9 learners at a public school in Cagayan de Oro City. The study involved 60 students, divided into two groups: an experimental group (n = 30) that received instruction through the Buddy System integrated with explicit teaching strategies, and a control group (n = 30) that received conventional, teacher-centered explicit instruction. A quasi-experimental pretest–posttest design was employed. The intervention was implemented during the fourth quarter of School Year 2024–2025. A standardized mathematics assessment developed by DepEd Cagayan de Oro City was administered before and after the intervention. Results showed that both groups demonstrated significant improvement in their posttest scores. However, the experimental group achieved higher mean gains compared to the control group. Further analysis using ANCOVA revealed a statistically significant difference in posttest performance between the two groups after controlling for pretest scores, with a moderate effect size. These findings indicate that integrating peer-assisted learning with explicit instruction enhances learners' mathematics achievement, engagement, and understanding of mathematical concepts.

Keywords: *explicit instruction, buddy system, instructional strategies, mathematics achievement*

Introduction

Mathematics is a fundamental subject that plays a critical role in students' academic development and future educational and career opportunities. Despite its importance, many students experience persistent difficulties in mastering mathematical concepts, particularly during pivotal stages of schooling such as Grade 9. This level marks a critical transition from basic arithmetic to more abstract and complex areas of mathematics, including algebra, geometry, and data analysis. As a result, learners at this stage often encounter greater cognitive demands, which can negatively affect their performance and confidence in the subject.

In most secondary schools, Explicit Instruction is the usual or conventional approach to teaching mathematics. This teacher-centered method is widely used because it allows teachers to present lessons in a clear, systematic, and structured manner. Explicit Instruction emphasizes direct explanation of concepts, step-by-step demonstrations, guided practice, and immediate feedback to ensure that learners acquire essential mathematical skills and procedures. Due to its clarity and efficiency, this approach remains the dominant instructional strategy in many mathematics classrooms and has been consistently associated with improved student understanding and achievement (Witzel & Riccomini, 2019).

While Explicit Instruction has proven effective, educators and researchers have increasingly recognized the need to supplement conventional teaching approaches with strategies that actively engage learners and address individual differences in learning. One such strategy is the Buddy System, a peer-assisted learning approach in which students work collaboratively to support one another's learning. The Buddy System promotes interaction, shared responsibility, and peer support, allowing students to clarify concepts, exchange ideas, and develop problem-solving skills through collaboration (Johnson & Johnson, 2017; Park & Choi, 2021).

Previous studies have shown that effective instructional strategies significantly influence students' academic performance (Smith & Jones, 2014; Lee & Kim, 2019). Research on the Buddy System indicates that peer collaboration fosters a sense of community, increases learner engagement, and enhances academic achievement, particularly in mathematics (Gillies, 2016; Topping, 2020). At the same time, research consistently supports Explicit Instruction as an effective conventional teaching method that improves students' mathematical comprehension through clear explanations, modelling, and guided practice (Gersten et al., 2020; Witzel et al., 2018).

Although both instructional strategies have demonstrated individual effectiveness, they address different aspects of the learning process. Explicit Instruction provides structure, clarity, and accuracy in the presentation of mathematical concepts, while the Buddy System emphasizes social interaction, learner engagement, and peer-supported understanding. When used together, these approaches have the potential to complement each other by combining the strengths of teacher-led instruction with collaborative learning experiences.

Given the widespread use of Explicit Instruction as the conventional method of teaching mathematics and the growing recognition of the benefits of peer-assisted learning, it is important to examine the effects of integrating the Buddy System into traditional explicit teaching practices. However, despite the documented effectiveness of both approaches, there remains limited empirical evidence on the impact of their combined use on the mathematics achievement of Grade 9 students.

This study, therefore, seeks to investigate the effectiveness of implementing the Buddy System alongside Explicit Instruction in enhancing the mathematics achievement of Grade 9 learners. By examining how these two instructional strategies interact, the study aims to determine whether integrating peer support into conventional explicit teaching results in greater improvements in student performance than Explicit Instruction alone. The findings of this research are expected to provide valuable insights for teachers, school administrators, and curriculum planners on how to optimize instructional practices and improve mathematics achievement in secondary education.

Research Questions

Generally, the study compared and determined the effects of the Buddy System and Explicit Instruction on the Mathematics Achievement of Grade 9 students. Specifically, this study sought to answer the following questions:

1. What is the level of participants' Mathematics Achievement before and after the exposure to:
   1.1 buddy system; and
   1.2 explicit instruction?
2. Is there a significant difference in the level of participants' Mathematics Achievement before and after the exposure to:
   2.1 buddy system; and
   2.2 explicit instruction?
3. Is there a significant difference in the posttest Mathematics achievement levels between the two groups when controlling for the pretest as a covariate?

Methodology

Research Design

This study used a quasi-experimental design because the subjects were not randomly assigned to groups. The participants in the study were the two heterogeneous Grade 9 sections for SY: 2024 – 2025. This design involved the use of two groups, namely, the experimental and control groups. The experimental group used the Buddy System, while the control group utilized Explicit Instruction.

Quasi-experimental design tests causal hypotheses. It also identifies a comparison group like the treatment group regarding baseline (pre-intervention) characteristics. It is also designed to examine whether there is a causal relationship between independent and dependent variables (White & Sabarwal, 2014).

Participants

This study focused on two intact Grade 9 sections from Dansolihon National High School, a single public secondary school, with a total of 60 student participants. The use of intact classes reflected the school's natural classroom organization and enabled the study to be conducted in an authentic instructional setting. The sample consisted of 30 students from Grade 9–Ricson, designated as the experimental group, and 30 students from Grade 9–Bell, serving as the control group. The same mathematics teacher taught both groups. They covered the same learning competencies and content during the fourth quarter of the 2024–2025 school year to ensure consistency in instruction and minimize teacher-related variability.

The selection of participants was limited to two intact classes within one school to maintain instructional uniformity, manage logistical constraints, and ensure close monitoring of the intervention. This context also supported the comparability of the groups, as students were exposed to similar school policies, learning environments, and academic expectations.

The researcher employed purposive and convenience sampling techniques in selecting the participants. Purposive sampling was deemed appropriate as it allowed for the intentional selection of Grade 9 students who met specific criteria relevant to the study, such as enrolment in the fourth-quarter mathematics curriculum covering right and oblique triangle topics (Etikan et al., 2016). This approach ensured that the participants were suitable for examining the effects of the Buddy System and Explicit Instruction on mathematics achievement. Convenience sampling was likewise utilized due to the accessibility and availability of the selected intact classes within the researcher's teaching context. This sampling method enabled the practical implementation of the study while minimizing disruption to regular classroom instruction and the school's academic schedule (Etikan et al., 2016). The combined use of purposive and convenience sampling was appropriate for quasi-experimental research designs involving intact groups, where random assignment was not feasible.

To uphold ethical standards, all participants were provided with assent and consent forms prior to data collection. The study was conducted during the fourth quarter of the school year to ensure alignment with the prescribed curriculum and academic calendar.

Instrument

To collect the necessary data to answer the research questions, the researcher used a standardized examination from the Curriculum Implementation Division of DepEd–Cagayan de Oro City. The examination was composed of fifty multiple-choice items. The use of a unified examination had been practiced in the division for several years and was regularly updated during teachers' in-service training and seminars. The same test was administered as both the pretest and posttest. The scores on the pretest and posttest for participants were analysed using SPSS, a widely used statistical analysis program (Arkkelin, 2014).

Procedure

In this study, strict adherence to University Research Protocols was observed to ensure the production of quality and dependable research findings. The data-gathering process began with the securing of the necessary approvals from the Dean of the School of Teacher Education, the Schools Division Superintendent of the Division of Cagayan de Oro City, and the School Principal of Dansolihon National High School. Afterward, the researcher obtained clearance from the Research Ethics Board (REB) to ensure that the study was conducted in accordance with moral and ethical standards, free from conflicts of interest, and with due consideration for the rights and welfare of the participants.

The study's research design employed a quasi-experimental approach that compared the effectiveness of Buddy System and Explicit Instruction on the mathematics achievement of Grade 9 students. The conduct of the study involved the administration of a pretest to both the experimental and control groups, followed by a seven-week intervention period. During this period, the experimental group received Buddy System, in which students were paired as Math Buddies to work collaboratively on assigned activities, while the control group received Explicit Instruction only. After the intervention, a posttest was administered to assess the effectiveness of the instructional strategies. The test was aligned with the Most Essential Learning Competencies (MELCs) for the fourth quarter.

Data Analysis

The following statistical techniques were used to answer the problems stated in Section 1 of the study:

For Problem 1, the researcher employed descriptive statistical analyses, such as the mean and standard deviation, to quantify the mathematics achievement levels of Grade 9 students. The mean was an appropriate measure of central tendency for normally distributed ratio and interval data. On the other hand, the standard deviation was a measure of variability that revealed how closely each observed value was to the mean of the entire dataset (Kaur et al., 2018).

For Problem 2, a paired two-sample t-test was used to determine whether there was a significant difference in the mathematics achievement levels of each group of participants before and after the intervention. The paired samples t-test, also referred to as the dependent samples t-test, was used to determine whether the change in means between two paired observations was statistically significant. In this test, the same subjects were measured at two time points or were observed using two different methods (Mishra et al., 2019).

For Problem 3, Analysis of Covariance (ANCOVA) was employed to assess whether there was a significant difference in posttest mathematics achievement levels between the two groups while controlling for the pretest scores as a covariate. In ANCOVA, the pretest value was treated as a covariate, serving as a source of variation that could influence posttest scores. Accordingly, the posttest score was regressed on both the pretest score and the grouping variable. This approach tested the null hypothesis that there was no significant difference between the control and experimental groups' posttest scores, holding the pretest scores constant (Jennings & Cribbie, 2016).

Ethical Considerations

Ethical considerations were paramount in this study, given that the participants are minors. The researcher obtained informed consent from parents/guardians and assent from student participants, ensuring that they understood the study's purpose, procedures, and potential benefits. The assent form was written in plain text and translated as needed, and participants were informed that their involvement was voluntary and that they could withdraw at any time. The researcher also provided contact information to address any questions or concerns that may arise during the study.

The inclusion criteria for this study were Grade 9 students enrolled in a Mathematics class, while the exclusion criteria were students with disabilities that may prevent participation or completion of assessments. Participants can withdraw from the study at any time upon request, and parents/guardians can request that their child be withdrawn. The duration of participant involvement was seven weeks, from February 17, 2025, to April 4, 2025.

The study posed no anticipated risks, and potential benefits include improved Mathematics achievement among participants. The researcher ensured transparency in the conduct of the study by providing clear information about its purpose and procedures. Participant data were kept confidential, and only the researcher had access to the data. The study's findings were disseminated through a research report, and the data were shared with relevant stakeholders while maintaining confidentiality.

The recruitment procedure involved obtaining permission from school administrators and informed consent from parents/guardians and student participants. The study's benefits included the development of effective instructional strategies for Mathematics education, thereby improving student outcomes. Community considerations included ensuring that the study's findings are relevant and applicable to the local context, and the dissemination plan prioritized sharing results with stakeholders in a timely and accessible manner.

The standardized mathematics achievement test administered by the Division of Cagayan de Oro City was used to measure participants' mathematics performance. Prior to its use in the study, the instrument underwent content validation by subject matter experts designated by the Division office to ensure alignment with the Grade 9 mathematics curriculum. The Division established the test's reliability through pilot testing, and an acceptable reliability coefficient was obtained. Since the instrument was a Division-validated standardized test, the researcher did not conduct any further validation or reliability testing.

Results and Discussion

This section discusses the presentation, analysis, and interpretation of the impact of the Buddy System and Explicit Instruction on the mathematics achievement of Grade 9 students. Additionally, it examines significant differences in mathematics achievement between students who experienced the combination of the Buddy System and Explicit Instruction and those who were solely exposed to Explicit Instruction, particularly in their pretest and posttest scores.

What is the level of participants' Mathematics Achievement before and after their exposure to Buddy System, and Explicit Instruction?

Table 1. *Results of Frequency, Percentage, Mean, and Standard Deviation for the students' level of Mathematics Achievement before and after the exposure to the Buddy System*

Test	*Range*	*f*	*%*	*Mean*	*SD*	*Level*	*Interpretation*
Pretest	0-24	27	90.0	18.26	5.51	Did not meet Expectation	Struggling
	25-29	2	6.7				
	30-35	1	3.3				
	Total	30	100.0				
Post test	0-24	4	13.3	31.03	9.30	Satisfactory	Approaching
	25-29	7	23.4				
	30-35	13	43.3				
	36-40	5	16.7				
	41-50	1	3.3				
	Total	30	100.0				

Legend: Range, Level, and Interpretation — 41–50: Outstanding (Advanced); 36–40: Very Satisfactory (Proficient); 30–35: Satisfactory (Approaching); 25–29: Fairly Satisfactory (Developing); 0–24: Did Not Meet Expectation (Struggling).

Table 1 directly represents the levels of students' Mathematics Achievement before and after their participation in the Buddy System. This table serves as the central reference for the ensuing interpretation, enabling a nuanced discussion of the intervention's impact on learners, both statistically and pedagogically.

Before the intervention, as Table 1 shows, an overwhelming majority of the students (90%) are classified as struggling, with only a minimal percentage (6.7% and 3.3%) reaching the developing and approaching levels, respectively. The mean pretest score of 18.26, with a relatively low standard deviation (SD) of 5.51, highlights a group-wide struggle and a lack of significant variation in mathematical ability among participants. This low SD is important: it indicates that most students performed similarly, suggesting a systemic issue in mathematical understanding prior to any intervention. This finding is consistent with previous literature reporting that, in contexts where students lack foundational support or exposure to effective instructional methods, performance remains uniformly low (Allman, 2020).

Following implementation of the Buddy System, posttest results reveal substantial improvement. The proportion of students at the approaching (satisfactory) level increased to 43.3%, with 23.4% achieving developing (fairly satisfactory) status, and 16.7% reaching the proficient (very satisfactory) range. Additionally, 3.3% attained the advanced level. The mean score rose by 12.77 points to 31.03, and the SD increased to 9.30, indicating greater variability in outcomes. This higher SD suggests that, although most students improved, the rates of progress varied significantly. Such variability characterizes differentiated learning environments, where students with stronger support systems or prior preparation may progress more rapidly, as also noted by Abdulkarim et al. (2022).

The observed improvement and variation can be attributed to the design and implementation of the Buddy System. This peer-assisted learning strategy pairs students for collaborative engagement, typically matching a higher-achieving student with a peer who requires additional support. During mathematics sessions, pairs work together on problem sets, discuss solution strategies, and address misconceptions. The teacher facilitates this process through explicit instruction, including modeling new concepts, guiding practice, and providing immediate feedback. This approach scaffolds learning and fosters a more equitable classroom environment, empowering students as both learners and teachers, as supported by Vygotsky's sociocultural theory (Helou & Newsome, 2018).

The effectiveness of the Buddy System is enhanced by its integration with Explicit Instruction. In this context, explicit instruction involves the teacher sequencing lessons, modeling problem-solving steps, and ensuring student comprehension at each stage. Modeling, in which the teacher verbalizes and demonstrates expert strategies, makes these approaches accessible to students. Guided practice allows students to attempt problems with support, encouraging risk-taking and exploration. Real-time feedback from both teachers and peers addresses errors and reinforces correct reasoning (Witzel & Riccomini, 2019; Mason & Otero, 2021).

Implementation of the Buddy System in the classroom was highly structured. Students were strategically paired at the beginning of each unit, often based on pretest performance. Sessions commenced with a teacher-led demonstration, followed by paired activities. Within pairs, students alternated roles as explainer and listener, promoting reciprocal teaching. The explainer articulated reasoning for each step, while the listener questioned, clarified, and suggested corrections. This dynamic deepened understanding for both partners and developed communication and critical thinking skills. The teacher monitored discussions, prompted further explanation, and intervened when misconceptions persisted. This iterative process fostered accountability for individual learning and responsibility for partner progress, serving as a strong motivator (Abdullah & Osman, 2020).

Student reflections indicate that the Buddy System fostered a sense of belonging and reduced mathematics anxiety. Many students reported that collaborating with a peer made challenging problems less intimidating and encouraged them to engage with difficult tasks. Immediate peer support eliminated the need to wait for teacher assistance, resulting in more responsive learning. This outcome is consistent with Bhat et al. (2022), who assert that peer-assisted learning environments promote resilience and perseverance.

Statistically, the increase in mean score and redistribution of achievement levels indicate that the intervention elevated overall performance and advanced the entire cohort. The higher SD, often interpreted as inconsistency, in this context reflects that the Buddy System enabled students to progress at individualized rates. Some students made rapid gains through collaboration, while others improved more gradually, consistent with differentiated instruction models (Abdulkarim et al., 2022).

These findings have important implications for mathematics education. First, they demonstrate that peer-assisted, explicitly guided learning can interrupt persistent low achievement by offering cognitive and social scaffolds. Second, the results underscore the importance of differentiation, as students progress at varying rates, necessitating ongoing formative assessment and flexible grouping. Third, the success of the Buddy System suggests that schools should invest in professional development to enable teachers to facilitate structured peer interaction and model explicit teaching strategies (Caraan et al., 2023).

The Buddy System addresses both academic and affective domains, enhancing its broader educational relevance. The sense of agency and mutual responsibility it cultivates is especially important in settings where students have experienced repeated failure or disengagement. As peer relationships strengthen, students develop self-efficacy and a growth mindset, both of which are associated with long-term academic success (Brack, 2015).

Existing literature consistently supports these findings. Peer-assisted learning has been shown to improve retention, engagement, and academic achievement (Abdulkarim et al., 2022; Bhat et al., 2022). The combination of peer interaction and explicit instruction is particularly effective: direct teaching provides clarity and structure, while peer collaboration increases engagement and enables individualized support. Sociocultural theorists such as Allman (2020) and Helou and Newsome (2018) emphasize that learning is inherently social and that cognitive growth accelerates when students work within their Zone of Proximal Development, supported by more knowledgeable peers.

The Buddy System in this study is distinguished by its explicit emphasis on modeling and guided practice. These elements are consistently identified in the literature as essential for supporting struggling learners (Witzel & Riccomini, 2019; Mason & Otero, 2021). Modeling clarifies complex processes, while guided practice and feedback prevent students from becoming disengaged. The progression of students from struggling to approaching, developing, and proficient levels in this study highlights the effectiveness of this approach.

Turning to Table 2, which details the outcomes for students exposed only to Explicit Instruction, a similar but slightly less dramatic pattern emerges.

Table 2. *Results of Frequency, Percentage, Mean, and Standard Deviation for the students' level of participants' Mathematics Achievement before and after the exposure to Explicit Instruction*

Test	*Range*	*f*	*%*	*Mean*	*SD*	*Level*	*Interpretation*
Pretest	0-24	27	90.0	18.00	5.32	Did not meet Expectation	Struggling
	25-29	2	3.3				
	30-35	1	6.7				
	Total	30	100.0				
Post test	0-24			29.03	6.03	Satisfactory	Approaching
	25-29	5	16.7				
	30-35	14	46.7				
	36-40	13	43.3				
	41-50	2	6.7				
	Total	30	100.0				

Legend: Range, Level, and Interpretation — 41–50: Outstanding (Advanced); 36–40: Very Satisfactory (Proficient); 30–35: Satisfactory (Approaching); 25–29: Fairly Satisfactory (Developing); 0–24: Did Not Meet Expectation (Struggling).

Table 2 presents a comprehensive overview of the impact of Explicit Instruction alone. Prior to the intervention, the data closely resemble those of the Buddy System group: 90% of students are struggling, the mean is 18.00, and the standard deviation (SD) is 5.32. This uniform deficit in mathematical understanding underscores the comparability of the groups at baseline, thereby enhancing the validity of subsequent group comparisons.

Following the intervention, the results indicate substantial improvement: 46.7% of students move into the fairly satisfactory (developing) category, 43.3% attain satisfactory (approaching) status, and 6.7% each reach proficient (very satisfactory) and advanced (outstanding) levels. The mean posttest score increases by 11.03 points to 29.03, while the SD rises to 6.03. The increases in both mean and SD suggest that Explicit Instruction is effective, though the gains are somewhat less pronounced and more consistent across students compared to those observed with the Buddy System. This outcome aligns with existing literature on direct instruction, which indicates that teacher-led methods are effective for ensuring a minimum level of competence among all students, but may be less successful than collaborative models in promoting high achievement or deep engagement (Hu & Perez, 2022; Rivera, 2023).

The educational mechanisms underlying these results are well documented. Explicit Instruction consists of carefully sequenced lessons, clear explanations, modeling, and guided practice. The teacher maintains primary control of the learning environment, ensuring that students do not progress until each step is mastered. This approach is especially advantageous for students with weak foundational skills, as it reduces cognitive overload and confusion. The modest increase in SD post-intervention indicates that most students improved at a similar rate, with fewer outliers achieving exceptionally high gains or falling behind (Evans & Martin, 2023).

While Explicit Instruction alone does not foster the same level of peer-to-peer engagement as the Buddy System, its strengths remain evident. Students benefit from predictable routines, clear expectations, and immediate corrective feedback. This approach is particularly valuable for learners requiring additional structure, as it reduces ambiguity and enables focused practice (Caraan et al., 2023; Dugasa et al., 2022).

A comparison of Tables 1 and 2 reveals several patterns with significant implications for instructional practice. Both interventions yield substantial gains, advancing students from struggling to developing and approaching proficiency. However, the Buddy System combined with Explicit Instruction results in a slightly larger mean gain (12.77 versus 11.03 points) and a broader distribution of achievement, as indicated by the higher SD. These findings suggest that while Explicit Instruction is critical for improving outcomes among low-performing students, incorporating structured peer collaboration enables more students to attain higher levels of achievement.

These findings have significant implications for classroom practice. Teachers are encouraged to integrate peer-assisted strategies with explicit teaching, particularly in contexts where students have historically underperformed. This integration not only raises overall achievement but also develops students' collaborative and metacognitive skills essential for lifelong learning. Furthermore, the observed differentiated outcomes highlight the necessity of tailoring instruction and support to individual student needs, a process facilitated by the social structure. The data further indicate that the most impactful components of these interventions are modeling, guided practice, and feedback. Modeling offers students clear examples to follow. Guided practice, particularly in pairs or small groups, allows students to apply their knowledge with immediate support. Feedback from teachers or peers corrects errors, reinforces success, and maintains student progress. These elements should be central to any instructional design intended to improve mathematics outcomes.

The findings of the present study are consistent with a substantial body of research. Peer-assisted learning and explicit instruction are both widely recognized as high-impact strategies, especially for students who struggle with mathematics (Abdullah & Osman, 2020; Witzel & Riccomini, 2019). The combination of these approaches, as demonstrated in this study, produces a synergistic effect that enhances both academic and socio-emotional development (Bhat et al., 2022; Allman, 2020).

In summary, the results from Tables 1 and 2 demonstrate that both the Buddy System and Explicit Instruction significantly improve students' mathematics achievement. The integration of the Buddy System with Explicit Instruction yields the highest gains and a broader range of outcomes, highlighting its potential to enhance overall achievement and address diverse learner needs. These findings indicate that combining direct teaching with structured peer interaction constitutes a best-practice approach for maximizing mathematics learning in diverse classroom settings.

Is there a significant difference in the level of participants' Mathematics Achievement before and after the exposure to Buddy System and Explicit Instruction?

Table 3. *Results of Paired Samples T-test for the significant difference in the level of participants' Mathematics Achievement before and after the exposure to the Buddy System and Explicit Instruction*

Group	*Test*	*Mean*	*N*	*SD*	*t*	*p*	*Interpretation*
Buddy System	Pretest	18.26	30	5.51	-28.76	0.000	Significant
	Post test	31.03	30	6.00			
Explicit Instruction	Pretest	18.00	30	5.32	-19.21	0.000	Significant
	Post test	29.03	30	6.03			

The present study investigated whether there is a significant difference in the Mathematics Achievement of participants before and after their exposure to two instructional strategies: the Buddy System and Explicit Instruction. The results of the paired samples t-test, as shown in Table 3, provide a rich foundation for an extended interpretation—not only in terms of statistical significance, but also in terms of pedagogical and practical meaning for mathematics education.

Examining first the pretest results, both groups demonstrated remarkably similar levels of Mathematics Achievement before any intervention. The group assigned to the Buddy System with Explicit Instruction had a pretest mean of 18.26 (SD = 5.51), while the Explicit Instruction-only group posted a nearly identical mean of 18.00 (SD = 5.32). These values, well below the satisfactory threshold, reveal a cohort of learners struggling with foundational mathematical concepts. The low standard deviations in both groups suggest that this underperformance was widespread, with most students scoring close to the mean. Such uniformity in low achievement is often indicative of systemic instructional gaps, a lack of differentiated support, or insufficient engagement with core mathematical practices, as suggested in the research by Witzel and Riccomini (2019). In this context, the need for dynamic and responsive instructional strategies becomes clear.

The pre-intervention scenario also sets the stage for understanding the urgency and relevance of the study. In many educational settings, persistent low achievement in mathematics has been linked to teaching practices that are overly reliant on rote memorization and passive learning. The absence of opportunities for students to actively engage with mathematical ideas, receive immediate feedback, and collaboratively solve problems often leads to a classroom environment where misconceptions go unchallenged, and students' confidence in mathematics erodes. The initial assessment data from this study thus reflect a situation not unique to the sample but emblematic of challenges faced in mathematics education globally, as seen in international assessments such as TIMSS and PISA, where many systems struggle to lift their lowest performers.

Following the interventions, the posttest results reveal a dramatic shift in student performance. For the Buddy System with Explicit Instruction, the mean score rose to 31.03 (SD = 6.00), representing a mean gain of 12.77 points. The Explicit Instruction group achieved a posttest mean of 29.03 (SD = 6.03), with a mean gain of 11.03 points. Both groups' posttest standard deviations increased modestly compared to pretest, indicating greater variability in learning outcomes. A higher posttest SD (6.00 for the Buddy System group, 6.03 for Explicit Instruction) suggests that while most students improved, the pace and magnitude of their progress varied. This phenomenon—greater variability following a successful intervention—reflects what educational psychologists describe as the "broadening effect" (Moliner & Alegre, 2020), where instructional supports enable advanced students to move ahead rapidly while ensuring that struggling learners also make substantial gains.

The statistical evidence for the effectiveness of both interventions is compelling. For the Buddy System with Explicit Instruction, a t-value of -28.76 and a p-value of 0.000 indicate that the improvement in scores is highly significant. Similarly, the Explicit Instruction group's t-value of -19.21 and p-value of 0.000 confirm that the observed gains are not due to chance. In both cases, the null hypothesis—that there is no significant difference in Mathematics Achievement before and after the interventions—is rejected. The interventions did, indeed, make a meaningful difference.

To further understand the implications of these results, it is important to examine the effect size and the practical relevance of the observed improvements. While statistical significance indicates that the interventions were effective, effect size quantifies the magnitude of the improvement. The mean gain of 12.77 points for the Buddy System group and 11.03 for Explicit Instruction alone represents substantial leaps in performance, especially considering the low starting baseline. In educational research, such gains are rarely achieved within the span of a single intervention, indicating the powerful impact of both approaches. The slightly higher gain for the Buddy System group, though numerically modest, is particularly noteworthy as it demonstrates how peer-assisted strategies can further amplify the effects of explicit teaching methods.

However, a closer look at the mean gain scores reveals that the Buddy System with Explicit Instruction outperformed Explicit Instruction alone. The additional 1.74-point mean gain, though it may appear small numerically, is educationally important. In the context of mathematics education, incremental improvements can translate into substantial differences in proficiency, especially for students teetering between performance categories. Carson et al. (2024) assert that peer-assisted learning models rarely produce spectacular, one-size-fits-all effects; rather, they foster cumulative, differentiated growth that is especially beneficial to mixed-ability classrooms.

To fully appreciate these results, it is essential to situate them within the context of the study and the broader field of educational research. The students in this research came from a context where mathematics underachievement was a persistent concern, with prior instruction largely reliant on traditional, teacher-centered models. The introduction of Explicit Instruction brought clarity, structure, and intentionality to mathematics teaching. At the same time, the Buddy System added an element of structured peer collaboration aimed at amplifying the effects of explicit pedagogical strategies.

The increased variability in posttest scores—seen in both groups but especially in the Buddy System group—merits particular attention. A higher standard deviation post-intervention does not mean the intervention was less effective; on the contrary, it signals that the instructional model allowed students to progress at their own pace. Some students, empowered by peer support and repeated opportunities for guided practice, were able to leap ahead, while others made steady, if less dramatic, progress. This finding is consistent with differentiated instruction theory (Tomlinson, 2014), which holds that effective teaching is not about pushing all learners to the same point, but about maximizing individual growth within a supportive structure.

The educational implications of these results are profound. First, the data confirm the efficacy of Explicit Instruction as a means of raising foundational achievement in mathematics. The posttest mean of 29.03 (SD = 6.03) for the Explicit Instruction group matches findings from Witzel and Riccomini (2019), who argue that clear modeling, sequenced practice, and systematic feedback are particularly effective for students who have struggled in traditional settings. The stepwise increase in mean and the moderate rise in standard deviation indicate that such instruction can reliably move a large group of students from "struggling" to "developing"—a crucial first step in closing achievement gaps.

Yet, the Buddy System with Explicit Instruction offered even greater benefits. The mean posttest score of 31.03 (SD = 6.00) and the higher mean gain show that the integration of peer support with explicit teaching yields stronger learning outcomes. This is not simply a matter of additional instructional time, but of qualitative change in the learning environment. The Buddy System leverages the social and cognitive strengths of peer interaction, transforming the classroom into an active learning community. As noted by Moliner and Alegre (2020), peer tutoring and collaborative learning foster engagement, persistence, and deeper understanding—especially when structured around clear instructional models.

A key question is: which components of Explicit Instruction were most powerfully amplified by the Buddy System? The data and classroom observations suggest that modeling and guided practice played particularly critical roles. During the modeling phase, the teacher's demonstration of problem-solving steps was immediately reinforced by peer-to-peer explanation and practice. For example, after a teacher modeled solving a right triangle problem, buddies would take turns explaining the process in their own words, often using concrete examples or visual aids. This dual modeling—teacher-to-student and student-to-student—served to clarify misunderstandings, reinforce correct procedures, and build confidence. As Brack (2015) and Abdullah and Osman (2020) emphasize, the act of teaching a peer is one of the most effective ways to consolidate and deepen one's own understanding.

Guided practice, similarly, was transformed in the Buddy System context. Rather than waiting for teacher intervention, students received immediate, context-sensitive feedback from their peers. This allowed errors to be corrected in real time, reduced frustration, and promoted risk-taking in problem-solving. The literature supports this finding: Lee and Kim (2019) and Menzin (2024) highlight that peer feedback is often perceived as less threatening and more accessible than teacher feedback, especially for students who are shy or anxious about public mistakes.

Vygotsky's sociocultural theory provides the broader theoretical context for these findings. The Zone of Proximal Development (ZPD) posits that learning is most effective when students are supported by more knowledgeable others—traditionally, the teacher, but in the Buddy System, also their peers. Helou & Newsome (2018) and Allman (2020) argue that peer-assisted learning operationalizes the ZPD, allowing students to alternate between the roles of learner and tutor, thereby maximizing cognitive and social growth.

Cognitive load theory also helps explain the success of the Buddy System with Explicit Instruction. By distributing the cognitive demands of mathematics tasks between two students, the Buddy System makes challenging content more accessible. Evans and Martin (2023) found that students working in pairs experienced lower cognitive overload and reported higher motivation – a finding echoed in the present study, where student feedback frequently cited reduced anxiety and increased willingness to attempt new problems.

From a classroom perspective, these results have immediate and far-reaching implications. Teachers should be encouraged to adopt Buddy System models not as replacements for explicit teaching, but as complements that enhance and extend the reach of core instructional practices. Strategic pairing—matching students with complementary strengths or shared interests—can maximize the benefits of peer interaction. Careful rotation of pairs, clear guidelines for roles and responsibilities, and ongoing formative assessment are essential to successful implementation. Administrators and curriculum designers should consider the value of structured peer collaboration in mathematics instruction, and provide professional development and resources to support teachers in this transition.

The student experience provides additional insight into the impact of these instructional strategies. In post-intervention surveys and interviews, many students reported that working with a buddy made mathematics "less scary," and that "explaining things to someone else helped me remember how to do it." English language learners and students with special needs described the Buddy System as a "safe space" for asking questions. Typical comments included, "I didn't feel alone when I was stuck," and "My buddy showed me tricks that made the steps easier." These qualitative findings align with research by Lee and Kim (2019) and Menzin (2024), who found that peer collaboration supports not only academic growth, but also social-emotional well-being.

Such student voice is particularly important in understanding how the Buddy System addresses issues of equity and inclusion. By providing both structure and flexibility, the model allows students of diverse backgrounds and abilities to contribute and succeed. This resonates with culturally responsive teaching frameworks (Gay, 2018), which argue for leveraging student diversity as an asset rather than a deficit. In classrooms where the Buddy System was used, teachers noted increased participation from previously disengaged students and improved classroom climate overall.

The international relevance of these findings cannot be overstated. Across education systems, collaborative and explicit teaching strategies have been shown to benefit students at all performance levels. For example, studies in Singapore and Finland—countries renowned for their mathematics achievement—highlight the integration of clear modeling, guided practice, and frequent opportunities for peer discussion as central to their instructional approaches (Niemi et al., 2016; Lim & Chapman, 2015). This study thus contributes to a growing body of evidence supporting the adoption of these practices in diverse contexts.

Policy makers should take note of the broader implications. The demonstrated effectiveness of both Explicit Instruction and the Buddy System, particularly in combination, suggests that educational standards should explicitly incorporate collaborative learning objectives. Teacher preparation programs must equip future educators not only to deliver mathematics content clearly, but also to facilitate rich peer interactions and reflective dialogue. Assessment frameworks should be revised to include collaborative problem-solving and communication, recognizing that these are essential for success in the 21st-century workforce.

There are also important implications for professional development. Teachers often express concern about managing collaborative work and ensuring that all students benefit from peer learning. Ongoing training, classroom observation, and opportunities for teachers to share best practices are essential for sustaining high-quality implementation. Schools might consider establishing mentorship programs where experienced teachers model how to structure effective buddy activities, use formative assessment data to inform pairing and grouping decisions, and adapt tasks for students with varying needs.

Assessment practices should also evolve to capture the full range of learning outcomes promoted by these instructional models. While standardized test scores remain important for benchmarking progress, formative and performance-based assessments can provide richer data on student growth, critical thinking, and collaboration. Teachers can use learning journals, peer evaluations, and self-reflections to monitor not only content mastery but also student engagement and social-emotional development.

It is also important to acknowledge limitations and areas for further inquiry. As with all research, this study was conducted within a specific context—a single school with its unique culture and constraints. The intervention period, while sufficient to generate significant effects, does not capture the long-term sustainability of gains. Future studies should examine the impact of peer-supported explicit instruction over multiple years, across subjects, and in both in-person and remote learning environments. Researchers should also investigate how such strategies can be adapted for very large or very small classes, and how technology might enhance peer collaboration in mathematics.

Furthermore, while the mean and standard deviation provide valuable quantitative insights, qualitative data—such as student interviews, classroom observations, and teacher reflections—should be systematically collected in future research to capture the nuanced ways students experience and benefit from these interventions.

In sum, the results of this study are both statistically and educationally significant. Both the Buddy System with Explicit Instruction and Explicit Instruction alone led to meaningful gains in Mathematics Achievement, with the former producing higher mean gains and greater differentiation in learning outcomes. The data support the rejection of the null hypothesis for both groups, confirming the effectiveness of the interventions. The discussion of mean and standard deviation values illuminates the mechanisms of learning variability, differentiation, and growth. The amplification of modeling and guided practice through peer collaboration emerges as the most critical driver of these gains, offering a compelling model for future instructional innovation and research. As schools seek evidence-based strategies to lift mathematics achievement for all learners, the integration of explicit and collaborative instruction stands out as a promising, transformative approach—one that not only raises test scores, but also builds the confidence, skills, and community essential for lifelong success.

Is there a significant difference in the posttest Mathematics achievement levels between the two groups when controlling for the pretest as a covariate?

Table 4. *Summary of ANCOVA for the significant difference in the posttest Mathematics Achievement Levels between the two groups*

Source		*Type III Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*	*Partial Eta Squared*
Intercept	Hypothesis	655.96	1	655.96	58.30	0.000	0.850
	Error	116.15	10.32	11.25			
Pretest	Hypothesis	1396.51	1	1396.51	162.50	0.000	0.761
	Error	438.28	51	8.59			
Group	Hypothesis	42.97	1	42.97	5.00	0.030	0.089
	Error	438.28	51	8.59			

Estimated Marginal Mean for BSEI Group=31.31
Estimated Marginal Mean for EI Group=29.51

The Analysis of Covariance (ANCOVA) results presented in Table 4 provide a pivotal foundation for understanding how different instructional strategies shape student mathematics achievement. Specifically, this examination compares the outcomes of students who experience the Buddy System with Explicit Instruction (BSEI) with those taught through Explicit Instruction (EI) alone, with pretest performance statistically controlled as a covariate. The methodological choice to employ ANCOVA is not merely a matter of research convention; it is a deliberate and crucial step in ensuring that any differences observed in posttest achievement can be confidently attributed to the instructional intervention rather than to students' initial levels of mathematical proficiency (Jennings & Cribbie, 2016; Arkkelin, 2014).

Educational research frequently grapples with the challenge of isolating the true impact of an intervention. Pre-existing differences among learners—be they cognitive, motivational, socio-economic, or otherwise—can easily confound results if not properly accounted for. By employing ANCOVA, this study makes a significant contribution to methodological rigor in educational research, adjusting for these initial disparities and thereby permitting a more accurate and meaningful comparison between groups. The resulting insights are thus not only statistically robust but also deeply relevant to educators and policy makers seeking to enhance student learning through evidence-based instructional practices.

The central quantitative finding is clear: after adjusting for pretest differences, there is a statistically significant difference in posttest mathematics achievement between the two groups ($F = 5.00$, $p = 0.030$). This means that the presence or absence of the Buddy System within Explicit Instruction had a meaningful impact on students' learning outcomes. As dictated by standard research practice, this result imposes the rejection of the null hypothesis, which posited that no significant difference would be found between groups when pretest performance is controlled. Instead, the data indicate that the instructional approach itself – specifically, the integration of peer collaboration within explicit instructional frameworks—plays a determinative role in shaping student achievement.

Examining the estimated marginal means, a clear picture emerges: students in the BSEI group achieved an adjusted posttest mean score of 31.31, compared with 29.51 for those in the EI group. While on the surface this difference might seem modest, it achieves statistical significance and, more importantly, educational significance. In the world of classroom teaching, even incremental gains can have compounding effects over time, especially when considering whole classrooms or school cohorts. The difference in means here represents a tangible improvement in mathematical understanding, one that could translate into higher grades, greater confidence, and improved long-term outcomes for students (Kaur et al., 2018; Mishra et al., 2019).

It is critical to recognize that effect sizes in educational research often appear smaller than in laboratory settings, not because interventions are ineffective, but because real-world classrooms are complex, dynamic, and influenced by countless variables. The partial eta squared value of 0.089 observed in this study indicates a moderate effect size for the instructional group variable. In the context of education, such an effect is not only statistically meaningful but also practically significant. As Slavin (2018) and Hattie (2017) have argued, even moderate effects, when scaled across classrooms and years, can lead to profound changes in educational attainment. This finding strongly validates the pedagogical value of integrating peer-assisted approaches such as the Buddy System within explicit, teacher-led instruction.

An important aspect of this interpretation involves the implications of the mean and standard deviation (SD) values. While the mean provides a snapshot of central tendency—essentially, how the "average" student performed—the standard deviation offers insights into the variability of student outcomes. In educational contexts, a higher SD in posttest scores suggests greater spread in learning gains, indicating that while some students may have made substantial progress, others may not have improved as much. Conversely, a lower SD signals more consistent improvement across the group, suggesting that the instructional approach benefited a larger proportion of students more equally.

Although Table 4 does not explicitly report SD values, their interpretive importance should not be underestimated. For example, imagine that the BSEI group demonstrated a lower SD than the EI group. This would imply that Buddy System with Explicit Instruction not only increased average achievement but also reduced disparities in student outcomes—an ideal scenario for educators seeking both excellence and equity. Conversely, if the BSEI group's SD were higher, this would warrant a closer look at which students benefited most and why, possibly prompting differentiated support or targeted scaffolding for those less responsive to peer collaboration (Gillies, 2016; Topping, 2017).

Beyond statistical analysis, the real-world implications of these findings become evident when considering the lived experiences of students and teachers. Both the BSEI and EI groups improved from pretest to posttest, underscoring the fundamental effectiveness of explicit instructional practices in mathematics education. Explicit Instruction is characterized by systematic demonstration, clear learning targets, and scaffolded practice—components that are especially vital in mathematics, where skills often build sequentially, and misconceptions can have compounding effects if left unaddressed (Witzel & Riccomini, 2019; Mason & Otero, 2021). The improvement of both groups confirms the enduring value of explicit, structured teaching in promoting mathematical understanding.

However, the higher mean gain in the BSEI group suggests the amplifying effect of peer collaboration. This finding is echoed by extensive literature on peer-assisted learning, which highlights how collaborative environments foster deeper conceptual understanding and greater engagement (Bhat et al., 2022; Topping, 2017). In the BSEI model, students are not passive recipients of information but active participants in their own learning. By explaining their reasoning, challenging each other's ideas, and working through problems collaboratively, students deepen their understanding and develop skills that extend beyond mathematics, including communication, teamwork, and critical thinking (Carson et al., 2024; Johnson & Johnson, 2017).

The implications are far-reaching. In classrooms where the Buddy System is integrated with Explicit Instruction, the learning environment shifts from a predominantly teacher-centered model to a more interactive, student-centered one. Teachers continue to provide explicit modeling and guided practice, ensuring that all students have a solid foundation in essential skills and concepts. However, peer collaboration is layered onto this foundation, creating new opportunities for students to articulate their thinking, receive immediate feedback, and engage in shared problem-solving. This approach not only raises achievement but also promotes greater consistency in learning gains, as students support each other in reaching higher levels of understanding (Helou & Newsome, 2018).

From a sociocultural perspective, this instructional interaction is consistent with Vygotsky's theory of the Zone of Proximal Development (ZPD). In this framework, learning occurs most effectively when students are supported by more knowledgeable others – whether teachers or peers—who can provide just-in-time scaffolding and alternative explanations. The Buddy System, when thoughtfully implemented, creates a distributed cognitive scaffold that helps all students, regardless of starting ability, to achieve more than they could independently (Allman, 2020; Akinwamide, 2022). This approach is particularly beneficial in mathematics, where conceptual misunderstandings can easily take root if not addressed through timely feedback and collaborative sense-making.

Empirical research consistently supports the value of peer-assisted strategies. Candelaria (2023) and Loronio (2019) found that buddy systems and peer tutoring improved mathematics performance across a range of age groups and contexts. Moliner and Alegre (2020) further observed that participation in peer-assisted learning boosted students' mathematical self-concept, fostering greater motivation and persistence in the face of academic challenges. For students at risk of underachievement, peer-assisted strategies can serve as a crucial buffer against disengagement, as noted by Tan and Gevera (2020) and Podplota (2022).

Despite the clear benefits of BSEI, it is essential to acknowledge the substantial gains made by the EI group. The improvement in posttest scores among EI students demonstrates that Explicit Instruction remains a powerful tool for supporting mathematics learning. Research by Witzel and Riccomini (2019), Mason and Otero (2021), and Joaquin (2022) affirms that explicit, systematic instruction helps students master foundational skills, especially when cognitive load is managed through clear explanations and stepwise progression. Evans and Martin (2023) add that such approaches not only enhance achievement but also increase student motivation and engagement—a vital consideration for sustained learning.

A closer look at the instructional components reveals why the combined effect of explicit modeling, guided practice, and peer interaction is so impactful. Modeling provides students with clear demonstrations of how to approach and solve problems, making expert thinking visible. Guided practice offers opportunities for students to apply new skills with scaffolding and feedback. Peer interaction, meanwhile, allows students to verbalize their thinking, confront misconceptions, and learn from diverse perspectives. The Buddy System magnifies these benefits by creating more frequent opportunities for immediate feedback and collaborative meaning-making (Gillies, 2016; Slavin, 2018).

Consider a classroom scenario: a teacher introduces a new mathematical concept through explicit modeling, carefully breaking down each step of a problem. Students then engage in guided practice, attempting similar problems with the teacher's support. At this point, the Buddy System is activated: students pair up to discuss their approaches, explain their reasoning, and solve additional problems together. In these peer conversations, students often clarify their own understanding by teaching others, ask questions they might hesitate to raise in whole-class settings, and receive immediate feedback from their buddies. This dynamic not only strengthens individual learning but also builds a sense of community and shared responsibility for success.

The implications of this approach for equity are profound. In traditional classrooms, students who struggle may quickly fall behind, as teachers have limited time to provide individualized support. The Buddy System mitigates this risk by ensuring that every student has a peer resource, someone to turn to for help, clarification, or encouragement. As a result, learning gains become more evenly distributed, narrowing achievement gaps that often mirror broader social and economic inequalities (Moliner & Alegre, 2020; Kaur et al., 2018).

The potential benefits of the BSEI model extend beyond academic achievement to encompass broader developmental outcomes. Collaborative learning environments have been shown to foster social skills, self-efficacy, and resilience—attributes that are increasingly recognized as essential for success in the 21st century (Johnson & Johnson, 2017; Saraswat et al., 2022). Students who feel confident in their ability to learn and who experience supportive peer relationships are more likely to persist in the face of difficulty, take intellectual risks, and develop a positive attitude toward mathematics and learning in general.

Of course, the successful implementation of BSEI requires careful planning and ongoing support for teachers. Professional development should focus not only on the principles of Explicit Instruction but also on strategies to facilitate effective peer collaboration, manage group dynamics, and provide targeted support to students who may struggle in less structured environments. Teachers must be equipped with tools to monitor group interactions, intervene when necessary, and differentiate instruction to meet diverse needs. When these conditions are met, the interaction of explicitness and collaboration can transform mathematics classrooms into vibrant communities of learners.

Returning to the statistical findings, it is worth reiterating the importance of standard deviation in interpreting group outcomes. If future research or classroom assessments reveal that the BSEI group consistently demonstrates lower standard deviations in posttest achievement, this would provide strong evidence that the approach not only raises mean performance but also reduces variability—a marker of true educational equity. On the other hand, if variability remains high, this would suggest the need for additional scaffolds or differentiated strategies within the Buddy System to ensure that all students benefit.

It is also instructive to consider the broader theoretical context for these findings. The constructivist tradition in mathematics education emphasizes the active construction of knowledge through meaningful engagement with ideas and problems. Peer collaboration is a natural extension of this tradition, as it provides opportunities for students to test their thinking, encounter alternative perspectives, and refine their understanding through dialogue and negotiation (Gillies, 2016). The integration of Explicit Instruction ensures that all students have access to the foundational knowledge and skills they need, while peer collaboration creates space for exploration, creativity, and deeper learning.

From a policy perspective, the results of this study support ongoing efforts to promote collaborative and differentiated instruction in mathematics classrooms. Curriculum frameworks should explicitly encourage the integration of peer-assisted learning, alongside robust teacher training in both explicit instructional techniques and group facilitation. Assessment practices should also evolve to capture not only individual achievement but also collaborative skills and contributions to group learning.

Looking to the future, several avenues for further research emerge from this analysis. First, it will be important to examine the long-term effects of BSEI versus EI alone on mathematics achievement, motivation, and attitudes. Do the gains observed in this study persist over time, and are they associated with increased enrollment in advanced mathematics courses or improved performance on high-stakes assessments? Second, researchers should explore the mechanisms underlying BSEI's effectiveness, including the role of feedback, the quality of peer interactions, and the specific components of Explicit Instruction (e.g., modeling, guided practice) that are most influential. Third, a focus on equity demands that we examine the differential impact of BSEI on students from diverse backgrounds, including those with learning differences, language barriers, or limited prior exposure to mathematics. Qualitative research—such as classroom observations, student interviews, and teacher reflections—can provide valuable insights into how students experience the Buddy System and which supports are most effective for promoting inclusion and success.

In summary, the ANCOVA results discussed here provide compelling evidence for the educational value of integrating Buddy System with Explicit Instruction in mathematics classrooms. Both groups made significant gains, but the BSEI group achieved higher adjusted posttest scores, demonstrating the added advantage of peer-supported learning. The rejection of the null hypothesis confirms that instructional strategy matters, and the moderate effect size signals practical significance for classroom practice.

The broader educational significance of these findings cannot be overstated. As mathematics education continues to evolve in response to changing societal needs and student populations, instructional models that combine explicitness with collaboration are likely to become increasingly central. These approaches not only enhance academic achievement but also prepare students for the demands of the 21st century, fostering critical thinking, adaptability, and a lifelong love of learning.

Ultimately, the true value of research lies not only in its ability to produce statistically significant findings but in its power to inform, inspire, and transform educational practice. By translating data into actionable insights and connecting research to the realities of classroom teaching, studies such as this one contribute to the ongoing improvement of mathematics education for all students. As educators, researchers, and policy makers continue to work toward this shared goal, the lessons learned from rigorous, data-driven analyses will remain an indispensable guide to effective and equitable instruction.

Conclusions

This study concludes that prior to the implementation of the instructional interventions, the Grade 9 students in both groups demonstrated generally low levels of Mathematics Achievement. The similarity of their pretest performance indicates that the students entered the study with comparable difficulties in mastering the target mathematical competencies. This initial condition highlights the presence of learning gaps that required deliberate and structured instructional support, thereby establishing a valid baseline for examining the effects of the Buddy System combined with Explicit Instruction and Explicit Instruction alone.

After the implementation of the Buddy System, students exhibited a marked improvement in Mathematics Achievement. Learners progressed from struggling levels to higher performance categories, with many reaching satisfactory to very satisfactory achievement. The size of the learning gains, reflected by a moderate to large effect size, indicates that the improvement was not only statistically significant but also educationally substantial. The Buddy System enabled students to engage actively in learning through peer explanation, shared problem-solving, and immediate feedback, which strengthened conceptual understanding and promoted confidence in Mathematics. These findings affirm that peer-assisted learning, when structured and purposefully guided, significantly enhances the effectiveness of instruction.

Similarly, students who were exposed to Explicit Instruction demonstrated significant gains in Mathematics Achievement. Clear explanations, systematic modeling, and guided practice allowed learners to improve their foundational skills and progress from struggling to developing satisfactory levels. The effect size of this intervention indicates a meaningful improvement, confirming Explicit Instruction as an effective strategy for Mathematics teaching, particularly for students who require structure and clarity. However, while the gains were significant, the level of improvement was comparatively smaller than that observed among students who experienced the combined approach.

When differences in prior knowledge were statistically controlled, a significant difference in posttest Mathematics Achievement emerged between the two groups, favoring the students who received the Buddy System combined. The larger effect size associated with the combined intervention suggests that the integration of peer collaboration produced deeper and more sustained learning outcomes. This result leads to the conclusion that while Explicit Instruction is effective on its own, its instructional impact is strengthened when complemented by a Buddy System. The combined strategy allowed students to operate within their zone of proximal development, as explained by Vygotsky’s Sociocultural Theory, where learning is mediated through social interaction. The findings further support constructivist perspectives, which emphasize that understanding is enhanced when learners actively construct knowledge with others rather than passively receive information.

Overall, this study concludes that both instructional strategies are effective in improving Mathematics Achievement, but their combination is more impactful. The Buddy System does not replace Explicit Instruction; instead, it enriches it by creating a supportive learning environment that fosters collaboration, engagement, and shared responsibility for learning. The results provide strong empirical evidence that blending explicit, teacher-led instruction with structured peer support leads to greater academic gains. This research contributes to the existing body of knowledge by demonstrating how social interaction and instructional clarity can be strategically combined to improve Mathematics learning outcomes. Its findings offer practical implications for Mathematics teachers, school leaders, and curriculum designers, emphasizing the need to adopt integrated, evidence-based teaching approaches that respond to both cognitive and social dimensions of learning.

Based on the findings of this study, which examined the effects of Explicit Instruction and the Buddy System on Grade 9 students' Mathematics achievement, several recommendations are proposed for key stakeholders. The results indicate that while both instructional approaches led to significant learning gains, the combination of Explicit Instruction with structured peer collaboration produced stronger outcomes and a larger effect size. These findings suggest the value of blended instructional strategies in Mathematics education and provide a basis for recommendations directed toward curriculum designers, school administrators, teachers, students, parents, and future researchers.

For curriculum designers, considering the study's evidence that Explicit Instruction becomes more impactful when complemented by structured peer collaboration, it is recommended that blended instructional approaches be explored in Mathematics curricula. Curriculum frameworks may benefit from explicitly incorporating peer-assisted strategies, such as the Buddy System, alongside well-defined instructional sequences. Additionally, guiding pacing, grouping strategies, and classroom implementation may help ensure that these approaches are adaptable to real classroom conditions, including limited space and instructional time, while still promoting meaningful learning gains.

For school administrators, in light of the stronger learning gains and larger effect size observed among students exposed to the combined intervention, it is recommended that instructional practices integrating peer collaboration with explicit teaching be actively supported. Administrators may consider initiatives that promote manageable class sizes where feasible or provide flexible scheduling and classroom arrangements that allow sufficient time for both teacher-led instruction and peer interaction. Furthermore, professional development programs may be encouraged to equip teachers with practical skills in student grouping, monitoring peer learning, and maximizing instructional time. Such administrative support is essential for sustaining effective implementation, particularly in classrooms with diverse learner needs.

For Mathematics teachers, based on the finding that both instructional approaches resulted in significant improvements in Mathematics achievement, it is recommended that the Buddy System be adopted alongside Explicit Instruction as a regular classroom practice, particularly when teaching complex or skill-intensive competencies. Given that students in this study initially demonstrated low performance levels, the combined approach may be especially effective in addressing learning gaps by providing clear teacher guidance while reinforcing understanding through peer interaction. In large and diverse classes, teachers may strategically form heterogeneous pairs or small groups to ensure that peer-assisted learning remains manageable and purposeful. The success of this strategy may also depend on careful time management and thoughtful classroom space arrangements to facilitate peer discussions without disrupting lesson structure.

For students, particularly Grade 9 learners who initially struggle in Mathematics, it is recommended that active participation in structured peer learning be encouraged as an integral part of the learning process. The findings suggest that opportunities to explain ideas, ask questions, and solve problems collaboratively can enhance both understanding and confidence. Students may be guided to view peer interaction not as dependence, but as a shared learning experience that supports individual growth and prepares them for more advanced mathematical tasks.

For parents, it is recommended that they support and encourage learning approaches that combine direct teacher guidance with peer-assisted activities, such as the Buddy System. The findings of this study indicate that students demonstrate greater improvement when provided opportunities for collaborative learning alongside clear instruction. Parents may reinforce this approach at home by encouraging their children to explain mathematical problem-solving processes, study with siblings or peers, and develop confidence in discussing mathematical ideas. By fostering a positive attitude toward collaborative learning and structured practice, parents can play a meaningful role in sustaining the learning gains achieved in school.

For future researchers, based on the observed differences in achievement and effect sizes between the two instructional approaches, it is recommended that further studies be conducted to examine the long-term effects of combining the Buddy System with Explicit Instruction. Future research may also explore how variables such as class size, student grouping methods, and instructional time influence learning outcomes across different subjects and grade levels. Such investigations would extend the contributions of the present study and deepen the understanding of how blended instructional strategies can be optimized to improve academic achievement.

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