



Using Dyadic Grouping to Address Learning Gaps in Linear Equation Lessons

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Abstract

Review Article

Mathematics is a fundamental subject that develops students' logical thinking and problem-solving skills. This quasi-experimental study investigated the effectiveness of dyadic grouping as an instructional strategy for improving Grade 8 students' performance in mathematics at Bannawag Integrated School (SY 2025–2026). The study compared dyadic grouping combined with lecture and the traditional lecture method using a pretest–posttest non-equivalent control group design. Results indicated that both groups improved, but the group exposed to dyadic grouping showed greater gains in solving linear equations. Effect size analysis revealed a large effect for the dyadic grouping strategy. In conclusion, dyadic grouping positively and significantly influences students' performance in solving linear equations. The study recommends integrating dyadic grouping into regular classroom instruction, providing support for its implementation, and conducting further research across different mathematical topics and grade levels.

Keywords: dyadic grouping, linear equations, mathematics, problem-solving, instructional strategy.

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Introduction

Mathematics is a significant core in the school curriculum as it builds logical and analytical thinking and problem-solving skills. However, mathematics is considered to be one of the most difficult subjects by most students, particularly algebra. Linear equations are among the fundamental pillars of algebra and form a transition between lower mathematics and higher mathematics. Learners have felt confused and frustrated because of it, which leads to a prolonged lack of achievement in mathematics (Lee et al., 2020; Powell et al., 2021).

The common misconceptions in learning

linear equations occur when learners lack full comprehension of the prerequisite knowledge of variables, properties of equality, and logical procedures of finding the unknowns. These gaps add up, and learners become further behind in mathematics.

In the Philippine context, Filipino high school learners also experience these challenges (Dalisyay, 2024), particularly in algebraic reasoning and problem-solving. These issues are reflected in the low performance of students in Bannawag Integrated School, supported by the Rapid Math Assessment results showing most learners classified



as Emerging Not Proficient and Emerging Low Proficient.

The traditional instructional methods of lecturing restrict students from expressing themselves and clearing up misunderstandings. Many learners are not willing to pose questions, causing misunderstandings to go unresolved.

Peer-assisted learning, particularly dyadic grouping, involves placing students in pairs to learn together, share ideas, and clarify problems (Chua & Bhar, 2022; Campbell et al., 2024). It reduces anxiety, improves self-efficacy, and enhances mathematics performance (Arthur et al., 2022).

Therefore, this study aims to investigate the effectiveness of dyadic grouping in improving the understanding and performance of students in linear equations and to address learning gaps in mathematics.

Methodology

This study employed a quasi-experimental research design, specifically the pretest-posttest non-equivalent control group design, to determine the effectiveness of combining lecture and dyadic grouping in improving students’ achievement in Linear Equations in One Variable among 49 Grade 8 students from two intact sections at Bannawag Integrated School during the third quarter of the School Year 2025-2026. Purposive sampling was used to select the participants. Grade 8 Marangal (n = 25) was designated as the experimental group and received instruction through a combination of lecture

and dyadic grouping strategy, while Grade 8 Matatag (n = 24) served as the control group and was taught using the traditional lecture method only.

Data were collected using a 30-item researcher-made test aligned with the Most Essential Learning Competencies in Mathematics for Grade 8, administered as both a pretest and posttest. The instrument underwent content validation by experts and was found to be valid and appropriate for use. A homogeneity of variance analysis using Levene’s Test was conducted based on the results of the Diagnostic Test in Mathematics, confirming the comparability of the two groups before the intervention.

The intervention phase was conducted for a period of three weeks. The experimental group was taught using a combination of lecture and dyadic grouping strategy, while the control group was taught using the traditional lecture method. After the intervention period, the posttest was administered to both groups using the same set of test items as in the pretest under the same conditions. Data analysis involved frequency count and percentage, mean, standard deviation, independent samples t-test, Levene’s Test for Equality of Variances, Shapiro-Wilk Test, and Cohen’s d to determine the significant difference and effect of the instructional strategies on students’ performance in Linear Equations in One Variable.

Ethical considerations, including permission from the school principal, voluntary participation, confidentiality of responses, and proper use of data for academic purposes, were strictly observed throughout the study.

Results and Discussions

Table 1. Pretest Mean Percent Score in Linear Equation of the Respondents

Group	n	Mean	SD	t	p-value	Decision
Dyadic Group	25	66.53	6.27			
Traditional Group	24	67.22	6.73	-0.370	0.713	Fail to reject Ho

p-value ≤ 0.05 is significant



Based on the comparison of pretest mean percent scores in Linear Equations between the Dyadic Group and the Traditional Group. The Traditional Group (67.22%) was slightly higher than the Dyadic Group (66.53%). Nonetheless, the calculated t -value of -0.370 and the corresponding p-value of 0.713 show that the difference in pretest scores was not statistically significant.

The null hypothesis was not rejected because the p-value is more than 0.05. This means that the two

groups did not differ significantly in regard to their performance in algebra before the intervention. The outcome implies that the two groups possessed a similar level of prior knowledge in algebra, and hence, baseline similarity between them is achieved. This formed a baseline equivalence and enhanced the internal validity of the research, enabling the posttest difference to be safely associated with the structured dyadic grouping intervention instead of the existing differences in abilities.

Table 2. Posttest Mean Percent Score in Linear Equation of the Respondents

Group	n	Mean	SD	t	p-value	Decision
Dyadic Group	25	80.13	6.79	2.805	0.007	Reject Ho
Traditional Group	24	74.79	6.54			

p-value ≤ 0.05 is significant

The posttest results revealed that the Dyadic Group achieved a mean percent score of (80.13, SD = 6.79) than the Traditional Group (74.79, SD = 6.54). The t-value of 2.805 and p-value of 0.007 demonstrated that there was a statistically significant difference between the two groups.

The null hypothesis was rejected because the p-value was lower than 0.05. This meant that there was a huge difference between posttest performance in linear equations between the two groups. The results indicated that the students who were exposed to dyadic grouping were able to perform much better than the students who were taught through traditional means.

This finding was in line with that of Wang et al.

(2023), who indicated that dyadic groups fostered greater cognitive interactions and more consistent interaction patterns than bigger or single groups. These positive findings of the Dyadic Group meant that the structured pair-based interaction formed better reasoning, explanation, and conceptual processing on algebra tasks. Furthermore, the notable posttest performance improvement conforms with the results of Celedonio and Elicay (2024), who reported that structured peer interaction has a significant positive impact on academic performance relative to traditional approaches. The outcome indicates that the dyadic arrangement was effective in resolving the chronic challenges students encounter in solving equations and analyzing variables.

Table 3. Comparison of the Mean Difference of the Posttest and Pretest of the Respondents

Group	Posttest	Pretest	Mean Gain	SD	t	p-value	Cohen's d	Decision
Dyadic Group	80.13	66.53	13.60	4.40	5.512	< .001	1.570	Reject Ho
Traditional Group	74.79	67.22	7.57	3.18				

p-value ≤ 0.05 is significant

Cohen's d: small effect size = around 0.2
 medium effect size = around 0.5
 large effect size = around 0.8 or higher

The comparison of the mean gain scores of the Dyadic Group and the Traditional Group is presented to establish which form of instruction has produced a better rate of improvement. Independent samples t-test reveals that the mean gain of the Dyadic Group at 13.60 (SD = 4.40) was significantly higher than the Traditional Group's mean gain score of 7.57 (SD = 3.18). The calculated t-value of 5.512 with a p-value of less than .001 rejects the null hypothesis, implying that the difference between the learning gains is very statistically significant. This also suggests that the participants in the Dyadic Group learn better than their counterparts in the Traditional Group.

The rejection of the null hypothesis establishes that the increase in algebraic performance was significantly greater among students who participated in structured dyadic grouping compared to those who received traditional instruction. This major improvement is in consonance with the Sociocultural Theory by Vygotsky, which postulates that students will learn best when they are subjected to peer-to-peer scaffolding within their Zone of Proximal Development. The almost doubled greater mean gain of the Dyadic Group upholds the results of Wang et al. (2023), who observed that the patterns of interaction in dyadic groups are more stable and of higher quality compared to larger groups or individual work.

Furthermore, the findings support the arguments of Meyer et al. (2022), who suggested that the construction of solutions in pairs results in more profound thinking and strategic decision-making.

The statistics indicate that the dyadic interaction directly addressed the learning gap by enabling the students to explain the reasoning and receive corrective feedback from the partner, which is not usually present in traditional, lecture-based environments.

The empirical validation of the so-called scaffolding process is the almost twofold mean gain of the Dyadic Group (13.60) over the Traditional Group (7.57). The intervention was a support system within the Zone of Proximal Development of students by grouping students in pairs so that they could co-create knowledge by accessing immediate feedback and explaining the concept to each other. This group work culture must have contributed to less passive involvement of students in a large group, so that students were individually accountable for the progression of every algebraic transformation.

Moreover, the results of the magnitude of the difference yielded a Cohen's d value of 1.570, indicating a very large effect size. This reflects a highly substantial and meaningful impact of the dyadic instructional approach on students' learning outcomes. The magnitude of this effect size underscores the strength of the intervention, indicating that the dyadic approach not only improves performance but does so to an educationally significant degree. This suggests that collaborative learning structures, where learners work in pairs to process and apply mathematical concepts, can greatly enhance understanding and retention.

This also indicates that in the dyadic group, the performance was significantly better than in the traditional group. Therefore, a learner who is subjected to structured dyadic grouping will experience better performance than a learner who is taught in a traditional setup. On the other hand, the transition of a student into the traditional group after being in the dyadic group can lead to a reduction in performance as a result of a lack of peer-assisted support to increase understanding and problem-solving skills.

Finally, a large t-test value ($p < .001$) and an exceptionally large effect size ($d = 1.570$) are sufficient to affirm that structured dyadic grouping is an effective teaching tool to overcome learning gaps in secondary mathematics. These results are consistent with findings in local and global settings, as it has been noted by Moliner and Alegre (2020), Macapayad et al. (2024), and other authors that peer-assisted learning enhances procedural accuracy and conceptual understanding in Algebra. The dyadic approach provides a more just and interesting learning experience when compared to traditional instruction because it fills the gap in understanding as well as introduces linear equations in a manner that is more realistic.

Based on the results of this research, it can be concluded that dyadic grouping is an effective method for bridging the learning gap among Grade 8 students in linear equations compared to the traditional lecture method. While both groups showed improvement, the Dyadic Group demonstrated a more substantial gain relative to their initial performance.

Furthermore, the dyadic grouping strategy had a significant impact on students' performance, as reflected in the higher posttest mean score and mean gain score of the Dyadic Group compared to the Traditional Group. The results also indicated that both groups had similar prior knowledge before the intervention, but students exposed to dyadic grouping achieved better outcomes after the intervention. Therefore, the use of dyadic grouping in mathematics instruction, particularly in linear equations, is recommended as an effective approach to enhance students' understanding and performance.

Considering the conclusions made, the following recommendations are offered. Dyadic grouping can be enhanced in regular mathematics instruction to enhance the understanding, participation, and performance of the students in learning linear equations. Dyadic grouping is one of the instructional strategies that may be adopted by mathematics teachers and school administrators to improve the achievement and involvement of students in mathematics. Dyadic grouping can be applied to facilitate collaborative learning, whereby the students are given a chance to interact with other students, which enhances their conceptual knowledge and skills in solving problems in mathematics. Teachers may consider providing opportunities for students to engage in structured pair work to maximize interaction and participation. School administrators may support the implementation of dyadic grouping by encouraging its integration in classroom instruction. Future researchers may conduct similar studies using dyadic grouping in other mathematical topics and grade levels to further validate its effectiveness.

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