KNOWLEDGE BUDDY: A PEER-TUTORING INTERVENTIONAL STRATEGY TO IMPROVE THE PERFORMANCE LEVEL IN STATISTICS AND PROBABILITY

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ABSTRACT

This study focused on the development of structured lesson plans and learning activities for the purpose of facilitating peer tutoring in the domain of Statistics and Probability. The research encompassed two distinct sections of HUMSS 11 students enrolled at Biñan Integrated National High School in Biñan City, Laguna, Philippines. Through a randomized selection process, one section was designated as the peer tutored group, while the other served as the non-peer tutored comparison group. The implementation of peer tutoring took place within the framework of the Independent/Cooperative Learning (ICL) period, thereby providing an ideal context for collaborative learning experiences. The study drew upon diverse sources of data, including students' reflective entries, detailed observation notes, inputs derived from focus group discussions, and outcomes from quarterly tests. The findings unveiled a significant enhancement in learning activities brought about by the strategic amalgamation of cooperative and contextualized learning methodologies. The peer tutors, who had the opportunity to review and revise their understanding of the subject matter, displayed an elevated level of mastery due to their active involvement in tutoring their peers. This process not only bolstered their academic competence but also contributed to the expansion of their social circle, an increase in self-assurance, and a heightened interest in both learning and teaching the subject matter alongside their peer tutees. Conversely, the peer tutees benefited from immediate feedback provided by their tutors, fostering a sense of cooperation and group participation, and leading to heightened engagement and enthusiasm for learning. The research also underscored the superior performance of the peer tutored group, as evidenced by their quarterly test results, in comparison to the non-peer tutored group. Ultimately, the designed lesson plans and associated learning activities for peer tutoring were identified as pivotal elements in enhancing the overall learning experience and boosting the performance level of students in the realm of Statistics and Probability.

I. INTRODUCTION

Education is seen as a tool used to integrate people into society to set national goals and achieve high levels of progress, economic prosperity, scientific standards, cultural awareness, and technological progress (Fatawu et al., 2022). It is unquestionable that the quality of mathematics education in any country determines the development of science and technology. Math classes also play an important role for everyone. A meta-analysis study examining the relationship between school readiness and subsequent academic performance found that early development of mathematical skills influences children's mathematics performance. This has proven to be the correct prerequisite for good grades in other school subjects (Duncan, et al., 2007).

Statistics and probability hold significant importance as fundamental disciplines within the senior high school curriculum, falling under the umbrella of the K–12 Statistics curriculum. These domains play a crucial role as prerequisites for various applications, spanning research endeavors across diverse sectors. The integration of statistical and probabilistic reasoning is essential in fostering a comprehensive understanding of data interpretation and analysis. Unfortunately, a notable challenge arises from the absence of a strong foundational grasp of these concepts, leading to difficulties in comprehending complex information (Retutas, 2021).

According to Berso and Lorente (2020), students lose interest in mathematics due to its abstract character till they start to dislike it. Another subject where most students struggled and performed poorly was this one. Most students in the Philippines faced these difficulties. As a result, educators are continuously looking for interventions and teaching methods that will meet the different requirements of their students, particularly when it comes to the teaching of mathematics. Using peer learning is one of these tactics. Peer tutoring is an educational technique in which classmates who have received training and oversight from the classroom teacher teach students. It entails pairing up students of the same grade or age to work in pairs. It can be used to the entire class or just a select group of students to help with their education. The technique is applied in the classroom as an addition to teacher-directed instruction (Eskay, et al., 2012).

According to Sinyosi (2015) as cited by Mabena et al., (2021), poor learner performance in mathematics has been a global concern that has prompted developing countries to participate in initiatives to bring positive change in their communities.

Unfortunately, our country is experiencing this and the students of Grade 11 HUMSS of Biñan Integrated National High School feel a lack of interest in mathematics.

Because of this, the researcher thought of using a strategy to help students regain their interest in math which can improve their level of performance in mathematics called "Knowledge Buddy". It is a peer-tutoring study aimed at creating lesson plans for peer tutoring that included educational activities. Cooperative and contextualized learning approaches were included as aspects in the designed session plans with learning activities. It also aimed to identify the major learning experiences of the peer tutees and peer tutors, as well as the level of performance in statistics and probability of the peer and non-peer tutored groups. Established on the findings above, this study concentrated on peer tutoring as an interventional strategy during the students' independent and cooperative learning in Grade 11 HUMSS students enrolled in Statistics and Probability.

II. METHODOLOGY

This study employed a descriptive quasi-experimental research method, drawing upon quantitative approaches to data collection. The research framework involved the systematic investigation of a teaching strategy—peer teaching—in the context of Statistics and Probability education. To measure the effectiveness of this strategy, the researcher designed and implemented custom instruments aimed at assessing students' performance levels and learning outcomes.

In terms of research design, the pretest-posttest design was adopted to ensure the equivalence of the two groups under study before the implementation of the treatment. This design entails administering a pretest to both groups, providing a baseline measure of their initial performance. This step is crucial for establishing a foundation for comparison. Following the treatment in this case, the application of peer teaching as a teaching strategy a posttest will be administered to both groups. This posttest enables the researcher to gauge the immediate effects of the treatment on the outcome variables, in this case, students' learning outcomes and performance levels. By following this design, the study aims to ascertain the efficacy of peer teaching as well as to measure any discernible changes or improvements brought about by this strategy in the domain of Statistics and Probability education, aligning with the insights of Rogers and Revesz (2019).

This study employed a combination of primary and secondary data sources for a comprehensive investigation. The principal data sources encompassed participants who participated by providing responses to the questionnaire, constituting the primary foundation for the research's empirical insights. Complementing this primary data, secondary sources such as books, scholarly journals, periodicals, published papers, and relevant materials were tapped into. These secondary sources served as repositories of knowledge, contributing essential contextual background, theoretical frameworks, and foundational information required to support and enrich the study's analytical framework. The synergy between primary data gathered directly from respondents and the wealth of information gathered from diverse secondary sources played a pivotal role in facilitating a comprehensive and well-rounded exploration of the research topic.

This study involved a total of 60 participants selected from Grade 11 HUMSS students belonging to Bracket B at Biñan Integrated National High School. These participants exclusively represented the Grade 11 level under the Humanities and Social Sciences (HUMSS) academic strand, focusing on Statistics and Probability. This deliberate choice of participants from this specific academic strand and subject context ensures the study's targeted investigation and allows for an in-depth exploration of the effects, outcomes, or variables associated with the subject matter under consideration.

To effectively collect relevant data for the study's objectives, the researcher employed a custom-designed problem set centered around Statistics and Probability, incorporating concepts related to probability random variables. The creation of research instruments tailored to the study's specific goals will be meticulously crafted and subsequently subjected to validation processes. Within this section, an integral aspect involves the evaluation of developed lesson plans integrated with learning activities, designed for the purpose of peer tutoring. Expert teachers in mathematics assessed these lesson plans, ensuring their academic soundness and instructional efficacy. The lesson plans featured peer tutoring learning activities aimed at enhancing presentation and content delivery. Additionally, formal authorization from the school administration was sought, paving the way for the participation of the peer tutored group from Bracket B Grade 11 HUMSS, as well as the non-peer tutored groups—ultimately constituting the final 2 sections for the study. Ensuring ethical considerations, the informed consent of the respondents' parents was obtained, underscoring transparency and awareness regarding their participation in the research.

The following statistical tools were employed to analyze and interpret the data gathered in this study:

Mean. This was used to present the average score of the peer-tutored and non-peer-tutored groups in the researcher-made problem set.

Performance Level. The percentage was used to determine the performance level of the students in the periodic examination. Performance level can be computed as follows:

$$Performance\ level = \frac{mean\ score}{total\ score} \times 100$$

Performance Level	Mastery Level Descriptive Equivalence
92% and above	Complete Mastery
83% to 91%	High Mastery
75% to 82%	Mastery
51% to 74%	Near Mastery
25% to 50%	Low Mastery
24% and below	No Mastery

t-Test. t-Test was utilized to determine the significant difference between the performance level obtained by the peer-tutored and non-peer-tutored groups in the posttest and pretest for statistics and probability.

III. RESULTS AND DISCUSSIONS

3.1 Performance of the Peer Tutored and Non-Peer Tutored Groups

Table 1. *Pre-Test Results of Peer Tutored and Non-Peer Tutored Group Without Peer Tutoring (Pretest)*

| Group | Mean | Standard Deviation | Performance Level | | t-value | Significance* |
			%	Description	p-value*	
Peer Tutored	15.20	3.3672	50.67	Near Mastery	0.0000	Not Significant
Non-Peer Tutored	15.20	3.3876	50.67	Near Mastery	0.5000	

Table 1 presents a comparative analysis of performance outcomes from two distinct groups of students: the peer-tutored group and the non-peer-tutored group without the intervention strategy. Specifically, the focus is on their Pre-Test results. The calculated mean score of 15.20 for the peer-tutored group, accompanied by a standard deviation of 3.3672, implies a moderate average score with relatively consistent performance. In resemblance, the non-peer tutored group attained the same mean score of 15.20. This closeness in mean scores becomes even more significant when considering their respective achievements in the realm of statistics and probability. Notably, the peer-tutored group's performance is characterized as "near mastery," signifying a partial grasp of the subject matter. Similarly, the non-peer tutored group's performance also falls under the "near mastery" category, suggesting a similar level of comprehension deficit.

The resulting p-value of 0.5000 with $\alpha = 0.05$ from the t-test holds significance as it signifies a substantial statistical distinction between the mean scores of the peer-tutored group and the non-peer-tutored group. However, contrary to initial expectations, this outcome emphasizes that there is no statistically significant variation in performance between these two groups in the absence of the intervention strategy. This finding substantiates the conclusion that the peer-tutored group's performance on the long test did not significantly differ from that of the non-peer-tutored group, highlighting that factors beyond peer tutoring might have contributed to their performance levels.

Table 2. *Post-Test Results of Peer Tutored and Non-Peer Tutored Group With Tutoring (Posttest)*

Group	Mean	Standard Deviation	Performance Level %	Performance Level Description	t-value p-value*	Significance*
Peer Tutored	22.97	3.9696	76.57	Mastery	−16.074	
Non-Peer Tutored	16.03	3.6998	53.43	Near Mastery	2.79×10^{-16}	Significant

The data presented in Table 2 highlights the contrasting performance outcomes between two groups of students: the peer-tutored group and the non-peer-tutored group, in the context of the Post-Test. The mean score and standard deviation of the peer-tutored group were calculated at 22.97 and 3.9696, respectively, showcasing a relatively high average score with relatively low variability. In contrast, the non-peer tutored group achieved a mean score of 16.03. This disparity in mean scores is accompanied by a noteworthy observation concerning their performance levels in statistics and probability. The peer-tutored group's performance surpassed the threshold of "mastery," signifying that they had acquired a deep understanding of the subject matter. In contrast, the non-peer tutored group's performance only reached a level classified as "near mastery." The discernible distinction in performance levels implies that peer tutoring had a positive impact on the peer-tutored group, leading to superior results compared to the non-peer-tutored group. To establish the statistical significance of this difference, a t-test for paired two samples was conducted on the mean scores.

Remarkably, with $\alpha = 0.05$ the t-test yielded a p-value of 2.79×10^{-16}, an exceedingly diminutive value that underscores the substantive statistical variance between the mean scores of the two groups. This outcome firmly accentuates that the variance in performance between the peer-tutored and non-peer-tutored groups isn't merely attributable to random chance. Instead, it firmly bolsters the deduction that the peer-tutored group's performance during the periodic examination stood significantly superior to that of the non-peer-tutored group. Ultimately, the presented evidence in

this study strongly affirms the efficacy of peer tutoring in augmenting students' comprehension and performance within the realm of statistics and probability. This assertion is exemplified by the stark contrast in mean scores and the corresponding performance levels between the two groups, substantiating the advantageous impact of peer tutoring.

IV. CONCLUSION

Participating in peer tutoring sessions had a profound impact on both tutors and tutees. Tutors deepened their understanding by teaching peers and improved their communication and leadership skills. Tutees benefited from explanations by peers, fostering a comfortable environment for asking questions and better comprehension. This led to improved academic performance, as seen in higher scores on quarterly tests for the tutored group. This success extended beyond individuals, positively affecting overall classroom performance. The structured session plans and engaging activities not only enriched learning experiences but also boosted student performance, particularly in Statistics and Probability. Collaborative learning, tailored explanations, and active participation highlighted the significance of peer tutoring, showcasing its potential to optimize education and enhance academic achievement.

V. RECOMMENDATION

The researcher's suggestion to undertake an additional investigation into designing and validating lesson plans and learning activities specifically tailored for peer tutoring across diverse segments of Mathematics holds considerable promise. This endeavor could yield insights into the adaptability and effectiveness of peer tutoring within various mathematical contexts, enhancing its educational scope. Furthermore, the call for prolonged periods of peer tutoring holds significance in comprehending its broader impact on students. Extending the duration of these sessions could unveil how they contribute to enhancing students' grasp of core concepts, refining their process-oriented abilities, and sharpening their proficiency in problem-solving. By conducting longer peer tutoring interventions, educators can gain a more comprehensive understanding of how this approach influences students' overall cognitive development and math-related skills, potentially leading to refined and more effective educational practices.

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