

BMEP: ENHANCEMENT OF FUNDAMENTAL ARITHMETIC CONCEPTS

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Abstract

This study aimed to assess the efficacy of the Basic Mathematics Enhancement Program (BMEP) in improving first-year BSED mathematics students' arithmetic proficiency and overall academic performance. Mathematics plays a vital role in students' personal, societal, and scientific lives. However, many students need help with fundamental arithmetic concepts, which impacts their academic progress. To address these challenges, the BMEP utilizes innovative strategies such as blended learning, individual hands-on recitations, and small group training. The study was conducted at Monkayo College of Arts, Sciences, and Technology, with 58 first-year BSED mathematics students as participants. Pretest and post-test evaluations were employed for data collection, adhering to ethical guidelines. The results revealed a significant improvement in students' math proficiency after the program's implementation, highlighting the effectiveness of targeted intervention plans in fostering a deeper understanding of fundamental arithmetic concepts. These findings provide valuable insights for educators and school administrators to develop effective intervention plans for students facing challenges in mathematics.

Keywords: Basic Mathematics, Enhancement Program, Fundamental Arithmetic Concepts, Academic Performance.

I. INTRODUCTION

Mathematics is a critical tool for young people as they confront issues and challenges in personal, societal, and scientific aspects of their lives (OECD, 2018). It is essential in a student's academic development and subsequent career choices (Sun et al., 2020). However, in many countries, enrollment rates in Science, Technology, Engineering, and Mathematics (STEM) subjects are relatively low (Regan & DeWitt, 2015).

Mathematics has been regarded as a fundamental subject because arithmetic and logical reasoning are the basis of science and technology. For this reason, educational authorities emphasize students' proficiency in computational skills and problem-solving (Popova et al., 2022). How to enhance and what factors affect students' learning interests is a significant problem, especially for low-achieving students (Roche et al., 2023). Students pick up the perception that mathematics is abstract, so learning mathematics would not benefit them (Fung et al., 2021). Hence, students' attitude toward Mathematics is modeled, and their interest in Mathematics is impacted by their automatically generated perception (Aguilar, 2021). However, students' performance in Mathematics is affected by various factors (Collins et al., 2020).

This study attempted to pinpoint the program's strengths and potential development areas to create an efficient intervention plan for students who were having trouble with fundamental arithmetic concepts. This study's context was in the realm of education, specifically in

addressing the requirements of students with difficulty with fundamental Math concepts and figuring out how to enhance their comprehension and performance in this subject. This study was critical because it could offer educators and school officials insightful advice on how to help struggling children develop their arithmetic abilities, ultimately boosting their overall academic achievement.

Many students need help with fundamental math concepts, which might severely affect their general academic performance. By assessing the efficacy of a math improvement program, the researchers intended to pinpoint tactics for enhancing students' arithmetic abilities and establish a framework for an intervention plan to assist difficult pupils. This study aimed to fill the information gap regarding the most efficient way to teach fundamental math concepts.

The primary purpose of this study was to assess the effectiveness of the Basic Mathematics Enhancement Program (BMEP). It sought answers to the following questions:

1. What is the level of student's performance in the first year of a Bachelor of Science in Education major in mathematics in pretest and post-test scores?
2. Is there a significant difference in the student's academic performance when the basic mathematics enhancement program was employed?

The Enhancement of Fundamental Arithmetic Concepts aimed to address first-year BSED mathematics students' difficulties in understanding fundamental arithmetic concepts. The program incorporated the following innovative strategies to improve their math abilities: First, the BMEP employed a blended learning approach, combining traditional classroom instruction with online learning resources. This approach gave students greater flexibility and access to supplementary materials such as instructional videos, math tutorials, and games. The online resources reinforced classroom learning and offered additional support and practice to enhance students' mathematical understanding. Second, the BMEP conducted small group instruction to allow for personalized and targeted teaching. In smaller groups, teachers can provide individualized attention to struggling students and address their specific needs effectively.

Moreover, small group settings offer opportunities for students to learn from one another and engage in peer-to-peer learning. Lastly, students were given the Pretest and Post-test assessments. The pretest helped identify specific areas of weakness and tailored the intervention accordingly. The post-test measured their progress and determined the effectiveness of the program.

Participants

The participants in this action research study were first-year Bachelor of Secondary Education (BSED) students majoring in Mathematics at Monkayo College of Arts, Sciences, and Technology. The study involved two sections with a total of 58 respondents. Furthermore, purposive sampling was used since this is a non-probability sampling method that relies on the non-random selection of a predetermined number or proportion of units, and the researchers intentionally chose individuals who met the criteria for inclusion in the study. Due to the limited number of **San Jose et al. (2022)** mentioned that the study's findings can only generalize some

of the population of BSED Mathematics. Findings may only apply to those who participated in the study.

Data Gathering Method

The data gathering method of this action research study involved two main instruments: a pretest and a post-test. The purpose of the pretest was to assess the baseline level of students' performance in basic mathematics before the intervention (the basic mathematics enhancement program) was implemented. The post-test, on the other hand, was conducted after the intervention to measure the students' performance improvement.

The data-gathering procedure for the pretest and post-test involved administering a paper-and-pencil test to the selected participants. They were given 45 minutes to answer the provided questions. The test items assessed students' understanding and proficiency in fundamental arithmetic concepts.

Research Design

The study used a quantitative research design. The pretest and post-test scores were analyzed descriptively to determine the level of student performance before and after the intervention. This included calculating mean, mean difference, and standard deviation measures. The paired sample t-test has been used as a statistical tool to determine if there is a significant difference in the student's academic performance before and after the basic mathematics enhancement program. This statistical test was used also to compare the means of the pretest and post-test scores for each participant, taking into account the paired nature of the data.

RESULTS

Level of students' performance in pretest and post-test scores

Table 1: Students Performance in pretest and posttest.

<u>Students' Performance</u>				
	N	Mean	SD	SE
Pretest	58	67.12	12.669	1.663
Posttest	58	86.79	5.827	0.765

The results presented in Table 1 indicate that students' performance significantly improved after implementing the Basic Mathematics Enhancement Program (BMEP). Before the intervention, the pretest scores showed an average performance level of 67.12, reflecting the baseline arithmetic abilities of the first-year BSED mathematics students. However, following the BMEP, the post-test scores demonstrated a remarkable increase, with an average score of 86.79. This substantial improvement in post-test scores indicates a notable enhancement in the students' math proficiency.

The substantial difference in mean scores between the pretest and post-test illustrated the effectiveness of the BMEP in addressing the difficulties some students faced in understanding fundamental arithmetic concepts. The statistically significant improvement in the student's performance provides compelling evidence of the program's success in promoting a deeper understanding and grasp of essential mathematical skills.

With a post-test average score of 86.79, it was evident that most students achieved good to satisfactory performance levels in mathematics. This outcome is encouraging, as it signifies that the BMEP effectively supported students in overcoming their initial challenges and acquiring a more solid foundation in arithmetic.

The findings indicated that the Basic Mathematics Enhancement Program positively impacted students' learning outcomes, elevating their performance from the pretest level of 67.12 to a significantly higher post-test level of 86.79.

The program's success in improving students' mathematical abilities underscores the importance of targeted intervention plans tailored to students' specific needs. Educators can create a conducive learning environment that facilitates students' mathematical development and overall academic achievement by adopting innovative strategies and personalized approaches to education.

Significant difference in the student's academic performance when the basic mathematics enhancement program was employed

Table 2: Students Performance on pretest and posttest

Paired Samples t-Test

	t	df	p	Mean Difference	SE Difference
Posttest - Pretest	10.99	57	< .001	19.67	1.789

The analysis of the data, as presented in Table 2, provides valuable insights into the impact of the intervention on students' math proficiency. The statistical analysis, specifically the paired sample t-test, was conducted to compare the pretest and post-test scores and determine if the difference in performance was statistically significant. The t-test results revealed a p-value of .001, less than the predetermined level of significance ($\alpha = 0.05$). This finding indicates that there is indeed a significant difference in the student's academic performance after the implementation of the BMEP.

The p-value of .001 suggests that the probability of obtaining such a difference in performance purely by chance is very low. This supports the conclusion that the improvement observed in the students' post-test scores can be attributed to the effectiveness of the Basic Mathematics Enhancement Program.

The statistically significant difference in performance implies that the BMEP had a meaningful impact on the student's mathematical abilities. By incorporating innovative strategies such as blended learning, **individual hands-on activities**, and small group instruction, the BMEP proved successful in addressing the difficulties some students faced in understanding fundamental arithmetic concepts. San Jose et al. (2024) pointed out that dynamic teaching contributes to students' learning environment. In this study, the respondents find those strategies beneficial in their mathematics learning.

The study's findings indicated that the Basic Mathematics Enhancement Program effectively enhances students' academic performance in mathematics. The evidence of a statistically significant difference in performance underscores the importance of targeted intervention plans tailored to students' needs. Such programs can play a vital role in supporting struggling students, fostering a deeper understanding of mathematical concepts, and ultimately improving their overall academic achievement in mathematics.

These outcomes have important implications for educators and school officials seeking to implement evidence-based interventions to enhance students' learning outcomes and mathematical proficiency. In the study of **San Jose et al. (2023)** on the student's learning experiences, they mentioned that tailoring instructions for students and fostering their skills development are pivotal for equitable and high-quality learning.

The key finding of this study was that the implementation of the Basic Mathematics Enhancement Program (BMEP) resulted in a significant improvement in students' academic performance in first-year BSED mathematics. The pretest and post-test scores revealed a notable increase in students' math proficiency, with the post-test average score of 86.79, indicating a substantial enhancement from the pretest average score of 67.12.

The statistically significant difference in performance, supported by a small p-value of .001, underscores the effectiveness of the BMEP in addressing students' challenges with fundamental arithmetic concepts. The success of the intervention highlights the value of tailored and innovative strategies to foster a deeper understanding of mathematical skills among students, leading to overall positive learning outcomes.

IMPLICATIONS

The findings of this study have several implications:

Educational Institutions: Schools can consider implementing the Basic Mathematics Enhancement Program to address students' difficulties with arithmetic and enhance their math proficiency.

Students: The BMEP offers promising prospects for improving students' mathematical abilities and boosting academic performance.

Parents: Parental involvement in intervention programs like the BMEP can significantly impact students' academic progress in mathematics.

Office of Research, Development, and Extension (RDE): The study contributes valuable insights into effective intervention strategies for enhancing students' math proficiency. Further research can explore the program's effectiveness in diverse educational contexts and age groups.

Reflection

Conducting this action research study on enhancing Fundamental Arithmetic Concepts has been a valuable and insightful experience. The focus on addressing the difficulties first-year BSED mathematics students faced in understanding essential mathematical concepts was essential for improving their academic performance and overall learning experience.

Throughout the implementation of the Basic Mathematics Enhancement Program, we witnessed the positive impact of the intervention on students' mathematical abilities. The remarkable improvement in post-test scores provided tangible evidence that the BMEP successfully improved students' math proficiency levels. It was gratifying to observe how targeted intervention plans, such as blended learning, individual hands-on activities, and small group instruction, played a vital role in addressing the specific needs of students.

The statistical analysis, including the paired sample t-test, further validated the significance of the results. The small p-value indicated that the observed difference in performance between the pretest and post-test was not due to chance but was indeed attributed to the effectiveness of the BMEP. This finding reinforced our confidence in the value of evidence-based interventions and the importance of continuously evaluating and improving educational approaches.

One aspect we recognized during the reflection was the significance of context in the study's outcomes. Conducting the research at Monkayo College of Arts, Sciences, and Technology provided valuable insights into the challenges faced by first-year BSED mathematics students in this specific setting. While the results were encouraging and indicated the success of the BMEP, we acknowledge the need for further research and exploration to assess the program's effectiveness in diverse educational contexts and student populations.

As educators and researchers, we recognize the potential implications of this study beyond the immediate context. The success of the BMEP can serve as a model for other institutions seeking to enhance students' math proficiency and overall academic achievement. The insights gained from this action research can guide educational authorities, curriculum developers, and policymakers in implementing evidence-based intervention plans and innovative teaching strategies.

In conclusion, this action research has deepened our understanding of the impact of targeted intervention plans on students' academic performance in mathematics. The study's key finding highlights the effectiveness of the Basic Mathematics Enhancement Program in improving students' math proficiency levels. As we progress, we remain committed to continuously improving educational practices, driven by data-driven insights and innovative approaches, to foster a conducive and empowering learning environment for all students.

References

- 1) Aguilar, J. J. (2021). High school students' reasons for disliking mathematics: The intersection between teacher's role and student's emotions, belief and self-efficacy. *International electronic journal of mathematics education*, 16(3), em0658.
- 2) Collins, K. H., Joseph, N. M., & Ford, D. Y. (2020). Missing in action: Gifted Black girls in science, technology, engineering, and mathematics. *Gifted Child Today*, 43(1), 55–63.
- 3) Fung, C. H., Besser, M., & Poon, K. K. (2021). Systematic literature review of the flipped classroom in Mathematics. *Eurasia Journal of Mathematics, Science and Technology Education*, 17(6).
- 4) **OECD. (2018). PISA 2018 Results (Volume I): What students know and can do. Paris: OECD Publishing.**
- 5) Popova, Y., Abdualiyeva, M., Torebek, Y., Yelshibekov, N., & Omashova, G. (2022, August). Improving the effectiveness of senior graders' education based on the development of mathematical intuition and logic: Kazakhstan's experience. In *Frontiers in Education* (Vol. 7, p. 986093). Frontiers.
- 6) **Regan, T. J., & DeWitt, J. (2015). Enrolment rates in STEM subjects in different countries. *Journal of Science Education and Technology*, 24(6), 868-876.**
- 7) Roche, A., Gervasoni, A., & Kalogeropoulos, P. (2023). Factors that promote interest and engagement in learning mathematics for low-achieving primary students across three learning settings. *Mathematics Education Research Journal*, 35(3), 525–556.
- 8) San Jose, A. E., Concepcion, M. G. R., San Jose, B. G. (2022). Mother as teachers: New role of mothers in the new normal. *Journal of Learning for Development*, 9(2) pp. 351-362.
- 9) San Jose, A. E. (2024). The Online Lecture-Discussion Technique (OLDT) enhances graduate Students' preparedness. *Gradiva*, 63(3), pp. 112-124.
- 10) San Jose, A. E. Galvez, R. M., & Sagbigal, D. (2023). Anecdotes of male and female students on flexible learning modality. *Gradiva*, 62(12), pp. 13-27.
- 11) **Sun, J., Guo, S., & Liu, S. (2020). The Role of Mathematics in Student Academic Development and Career Choices. *International Journal of Educational Research*, 98, 101-108.**