PROJECT XM-BORG (eXcellence in Mathematics using BOaRd Games): An intervention learning material in refining basic arithmetic skills in Mathematics among Grade 8 students.

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ABSTRACT

The PROJECT XM-BORG (eXcellence in Mathematics using BOaRd Games) was conducted to determine the effectiveness of localized Mathematics board games in refining the basic and foundational skills in Mathematics of classified Grade 8 students in Mamplasan National High School.

The study came from learners classified in low proficient and non-numerates last School year 2022-2023. The research study is quasi-experimental wherein, the participating students were measured based on their pre- and post-assessment. Forty (40) students were selected from the Grade 8 in a public school in Biñan City were equally assigned to the control group and the experimental group. The control group utilized the traditional method of learning math while the experimental group made use of the localized board games (modified from Project XM-BORG).

The test of difference was used to determine the equivalence of both groups as well as the effectiveness of the treatment using a 0.05 level of significance. Results showed that the two groups obtained no significant difference in their pretest scores (α = 0.912) which acceptable the conduct of the test since the two groups are equivalent in terms of their admission knowledge. Moreover, it was observed between the pretest and posttest results for the experimental group (α = 0.001) and control group (α = 0.001). On the other hand, the experimental group's pretest and posttest of (p<0) at 0.05 level of significance.

This suggests that Project XM-BORG of delivering education is successful. Nonetheless, a significant difference was observed in the post-test results between the groups, indicating that the experimental group's employment of XM-BORG proved to be more successful than the control group's conventional approach. It has been demonstrated that using XM-BORG (Localized Mathematics Board Games) is more efficient than using traditional methods and enhances students' academic performance in mathematics

Keywords: board games, arithmetic skills, mathematics performance

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INTRODUCTION

Mamplasan National High School has struggled for the past two years to give its students a great foundational education, but it has never given up despite the difficulties, recognizing that education must continue notwithstanding the learning loss, the school has adopted the Basic Education Learning Continuity Plan in the past two years in accordance to DO 12 s. 2020.

In line with this study, the advent of DO 24 s. 2022 also known as the Adoption of Basic Education Plan (BEDP) 2023 helped the school in developing MNHS Learning Continuity Plan (LCP), BE-LRCP, School Implementation Plan (SIP), which anchored with SDO Binan City LRCP based on the recovery framework of the Region that aims to direct, assist, and support the schools in the operationalization of their strategic plans and action steps for the full face-to-face classes as well as to address the learning losses and gaps caused by the pandemic especially the numeracy of the students as one of the goal of this project.

According to the results of Trends in International Mathematics and Science Study (TIMSS) 2019, Philippines obtained an average achievement of 297, which is significantly lower than the TIMSS Scale Center Point (500) and had the lowest average achievement (297) among 58 participating countries and 6 benchmarking countries.

On the other hand, The Organization for Economic Cooperation and Development (OECD) assessment, Philippines scored 353 and was ranked second to the last out of 79 countries that participated in this subject assessment. The learners of the assessment were now the learners of Key Stage 3 in our present curriculum. The initiation of their progress will be at risk in this recovery stage of Philippine Education System that is why the Department of Education continuing the innovations in addressing the low proficiency level of learners.

The pioneering strategies that will cater the skills of students in mathematics is through board games as the Project XM-BORG core setting. Recent evidence indicates that playing numerical board games is beneficial for the numerical development.

However, board games used in these studies were often specifically developed for training numerical skills. (H. Gasteiger and K. Moeller, 2020).

Teachers noticed that 40% students were having trouble grasping the basic concepts in math during the implementation of Face-to-face classes. In actual fact, the mathematics department conducted a school-based diagnostic test to determine the classification of the learners in mathematics proficiency comprising the Most Essential Learning Competencies (MELCS) in Key Stage 2 Grade 4-6.

Based on the school-based pre-assessment results of grade 8 learners, it showed that 38 out of 244 students or 15.57% are in the Low Proficient while 56 or 22.95% are not proficient. The result of their Mean Percentage Score (MPS) of First Periodical Test in Mathematics 8 is 42.52.

The results prompted the researcher to an intervention material that served as a remediation in improving the numeracy skills of students of grade 8. The developmental plan inspired the researcher in pursuing the project with a title XM-BORG.

The study defined and investigated the development of students as they collaborated the mathematical skills in a board game-based learning. Furthermore, the study created an outlook for the teachers in crafting localized board games that supplemented the needs in mathematics instruction. The goal of the study provided a narrative analysis of the students' intervention and coping strategies of teachers as they implement the new mathematical teaching methods.

The study findings might give valuable information that will guide educational leaders to design meaningful educational programs that support the pursuit of a quality education in mathematics pedagogy. Also, the results can be a pertinent proposition to progressive insights that might be used to create educational strategies and regulations.

METHODOLOGY

The study transformed intervention learning materials in Mathematics with the

incorporation of localized board games addressing the arithmetic skills and fundamental operations. The instructional materials served as a pedagogical tool for the performance task of learners and satisfying the slit in the learning competencies among Grade 8 students.

Figure 1. Solution Strategy Flowchart o Project XM-BORG eXcellence in Mathematics using BOaRd Games
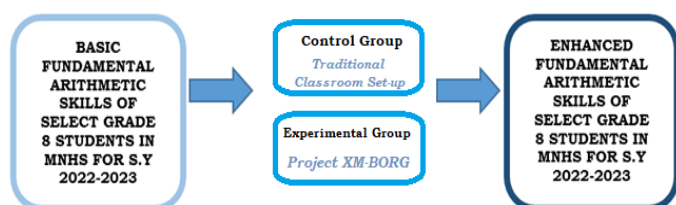
The subject for this research is the currently enrolled Grade 8 students at Mamplasan National High School categorized in fairly satisfactory (75-79) with low proficiency level and not proficient in 1st Quarter pre-assessment.

Mamplasan National High School has a total number of 215 Grade 8 students enrolled for academic year 2023 – 2024 as of first quarter. Thus, 40 students or 19% of the population who were categorized as fairly satisfactory in academic performance with a low proficiency level in pre-assessment will be used as the respondents of the study.

The researchers gathered the academic performance of the students' grades in their previous grade level were combined, and the students were grouped to ensure that each portion is evenly distributed, heterogeneously divided. Based on the percentage of situational report, the number of respondents in each section acknowledged.

Purposive sampling will be used in the choice of the Mamplasan National High School as the venue of the research. The total number of respondents were forty (40) Grade Eight students with twenty (20) respondents for control group and twenty (20) for experimental group categorized as fairly satisfactory in academic performance with a low proficiency level in pre-assessment. The respondents were purposively selected because the researcher handles grade 8 students belong to a heterogeneous group.

The experimentation group was made aware of by the researcher's localized/modified board games like *Damath board, and Modified Math Snake and Ladders*, once the exposure, board games' effectiveness would be measured. The standardized exam was utilized for evaluation in this research. The pre-test and post-test obtained from the across least learned competencies in Mathematics from Key Stages 2 (Grade 4-6) to Key Stage 3 (Grades 7-8) constructed by the researcher and validated by the experts from Mathematics Department such as Master Teacher I, Principal I and Education Program Supervisor in Mathematics.

A. Pre-Intervention Phase

1. The researcher pursued for endorsement and submitted the printed application form to the School Head's office to conduct the research.
2. After the approval, the researcher used purposive sampling in gathering his respondents with 40 participating students and asked the permission of the cooperating math teacher and coordinator about the implementation of the learning intervention material.
3. The researcher asked for parents' consent and students' assent for their engagement in the conduct of the study.
4. After the parents' approval, the researcher oriented the respondents about the action research by means of a 30-minutes conference and presented the details and procedure of the proposed research.
5. The researcher constructed a 40-item standardized pre-test assessment along with Table of Specifications that comprised the foundational and least learned competencies from Grades 4 to 8.

B. Intervention Phase

1. The researcher assured the reliability and validity of standardized test in Mathematics by getting the approval of Public Schools District Supervisor, Mathematics Coordinator and cooperating Math teachers.

2. A week after the pretest, the researcher crafted and designed innovative localized board games adopted in *Damath and Modified Math Snake and Ladders* based on the required competencies such as arithmetic, fundamental operations, comparison, fractions, integers and decimals.
3. The variety of designs per board games were shown on Table 2;
4. The day before the quarterly assessment, the grade level competition was conducted to formally recognized the efforts of the experimental group's respondents.
5. The experimental group utilized the context of Project XM-BORG and used it as an intervention learning material in supplementing the gaps in numeracy skills.

C. Post-Intervention Phase

1. After the intervention phase, the researcher administered the post-test to the experimental and control group and evaluated their personal experience about the intervention.
2. The researcher collected all the results and analyzed them using Statistical tools.
3. The researcher monitored the academic performance of the students after the intervention.

RESULTS

The effectiveness of Project XM-BORG will be determined using a true experimental approach. It was organized, compared, and evaluated in a quantitative approach. An analytical tool was utilized when examining numerical data.

Question 1. What is the level of academic performance of the students in Mathematics
1.1 control group?
1.2 experimental group?

Level of Academic Performance of the Controlled and Experimental Group
Table 4. Frequency Distribution of Pretest Scores

	Controlled		Experimental	
	f	**%**	**f**	**%**
Highly Proficient	0	0	0	0
Proficient	0	0	0	0
Nearly Proficiency	0	0	0	0
Low Proficient	6	30	8	40
Not Proficient	14	70	12	60
Mean	**7.55**		**7.60**	
Mean Percentage Score (MPS)	**18.88**		**19.00**	
Interpretation	**Not Proficient**		**Not Proficient**	

Table 4 presents the scores of the two groups in the pretest. It showed that majority of the learners in controlled group (f = 14, 70%) and experimental group (f = 12, 60%) classified as not proficient in the pretest. The mean percentage score of 18.88 and 19 also indicated students as not proficient in both groups.

Question 2. Is there a significant difference between the pretest and posttest scores of the students in the;
2.1 control group?
2.2 experimental group?

Table 5. Frequency Distribution of Posttest Scores

	Controlled		Experimental	
	f	**%**	**f**	**%**
Highly Proficient	0	0	1	20
Proficient	2	10	7	50
Nearly Proficiency	7	35	10	30
Low Proficient	11	55	2	0
Not Proficient	0	0	0	0
Mean	**16.70**		**23.40**	
Mean Percentage Score (MPS)	**40.00**		**58.50**	
Interpretation	**Low Proficient**		**Nearly Proficient**	

Table 5 shows the scores of the two groups on in the posttest. The scores exposed that students who used the traditional method classified as Low proficient with MPS of 40.00 (x =16.7), while the students who applied the XM-BORG were categorized as "Nearly Proficient" with MPS of 58.50 (x=23.40).

Table 6. Test of Difference Between Pretest of Two Groups

		Mean	Degrees of freedom	Critical t value	Interpretation
Pretest	Control	7.45	19	0.912	**Not Significant**
	Experimental	7.60			

*p < .05

Table 6 presents the test between the groups' pretests. It revealed that there was no significant difference in the pretest scores (α = 0.912) which implies that the two groups had parallel entry data about foundational skills in math, and is a good sign to advance the test.

Question 3. Is there significant difference between the academic performance of the control and experimental group?
3.1 pretest scores?
3.2 posttest scores?

Table 7. Test of Difference Between Pretest and Posttest of Experimental Group

		Mean	Degrees of freedom	Critical t value	Interpretation
Pretest	Pretest	7.6	19	0.000	**Significant**
	Posttest	23.4			

*p < .05

Table 7 presents the test between the experimental group's pretests (x = 7.6) and posttest (x = 23.4) . It revealed that there was significant difference in the pretest scores (α = 0.0000) which infers that the there is an improvement in mathematics performance.

Table 8. Test of Difference Between Posttest of Two Groups

		Mean	Degrees of freedom	Critical t value	Interpretation
Pretest	Pretets Experimental	16.7 23.4	19	0.001	**Significant**

*p < .05

The results revealed test scores in the groups' posttests. The mean score for controlled group is 16.7 described as Low Proficient (LP) while on the controlled group is 23 described as Nearly Proficient (NP). It showed that there was a significant difference in the posttest scores (α = 0.001) between the two groups.

Question 4. What implications can be presumed based on the findings?

The test of difference was used to determine the equivalence of both groups as well as the effectiveness of the treatment using a 0.05 level of significance. Results showed that the two groups obtained no significant difference in their pretest scores (α = 0.912) which acceptable the conduct of the test since the two groups are equivalent in terms of their admission knowledge.

The implication of the study using localized board games in mathematics or Project XM-BORG has been significant and far-reaching. It has brought about positive changes in various aspects of mathematics education, student engagement, and academic performance.

The study also positively impacts on problem-solving skills especially in most marginalized learners. By engaging in strategic thinking and decision-making within the context of the board games, they developed essential problem-solving abilities. Learning to analyze situations, make informed choices, and apply mathematical concepts to solve problems efficiently. These skills extend beyond the realm of mathematics and become transferable to real-life situations, equipping students with valuable problem-solving skills that will benefit them in various areas of their lives.

DISCUSSION

Appropriate plans, communication and the study also positively impact on problem-solving skills especially in most marginalized learners. By engaging in strategic thinking and decision-making within the context of the board games, they developed essential problem-solving abilities. Learning to analyze situations, make informed choices, and apply mathematical concepts to solve problems efficiently. These skills extend beyond the realm of mathematics and become transferable to real-life situations, equipping students with valuable problem-solving skills that will benefit them in various areas of their lives.

The findings demonstrate that using XM-BORG, which is a localized Mathematics board game, is more efficient than traditional methods of teaching. Not only does it engage students in a fun and interactive way, but it also enhances their academic performance in Mathematics. This research supports the implementation of XM-BORG as an effective tool for improving basic arithmetic skills and fostering a deeper understanding of mathematical concepts among Grade 8 students.

It has been shown that using locally themed board games for mathematics to improve fundamental arithmetic abilities and eliminate non-numerates is a successful and entertaining strategy. The PROJECT XM-BORG action research study has shed important light on the advantages of using these kinds of intervention learning resources.

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To sum up, the contemplation of employing localized board games to polish fundamental math abilities and eliminate non-numerates exposes the great worth of this strategy. It solves the problem of non-numeracy and improves student performance in addition to making learning pleasurable. Through the integration of intervention learning resources, teachers may provide a flexible and productive learning environment that meets the individual requirements of each student.

Project XM-BORG included to make mathematics an engaging subject. Students become more motivated and enthusiastic as a result, and it also helps to alleviate their fears and negative ideas about the subject. Learners get more enthusiastic about mathematics, which eventually boosts their self-esteem and makes them more eager to work with numbers.

In summary, the impact of the study using localized board games in mathematics or Project XM-BORG is significant. It positively influences students' attitudes, improves their arithmetic skills, develops problem-solving abilities, and works towards the eradication of non-numeracy. This innovative approach to mathematics education demonstrates the value of gamification and cultural relevance in creating effective and engaging learning experiences for students.

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