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SELF-MADE MODULE-BASED INSTRUCTION IN MATHEMATICS: ITS EFFECT ON THE BASIC MATHEMATICAL SKILLS OF GRADE 6 LEARNERS

Sheryl Jane D. Lecias[1]
[1]*Student, Graduate School, Rizal Memorial Colleges, Inc.*

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ABSTRACT

This research examined the efficacy of module-based learning in improving Grade 6 students' basic mathematics competencies. Employing a quasi-experimental approach, the study compared the achievement of students who were taught using module-based learning with that of students who were instructed based on the conventional method. The modules were carefully crafted to correlate with the mathematics curriculum, targeting basic concepts of operations involving, whole numbers, decimals and problem-solving techniques. Control and experimental groups were pre and post tested to measure learning gains. Data showed that students who were taught through module-based instruction significantly improved on their math skills relative to their peers in the traditional setting. The results of the study indicate that module-based instruction can be a potent pedagogy in the development of basic math skills among grade 6 students. It concludes that self-made, curriculum-aligned modules can serve as a valuable instructional strategy in grade 6 mathematics, particularly in promoting foundational skills among learners. It recommends the broader adoption and refinement of teacher-developed instructional materials to complement existing teaching methods, especially in resource-constrained or multi-level classroom settings. Future research may explore the long-term effects of such interventions and their applicability to other subject areas.

KEYWORDS- *Module-Based, Mathematical Skills, Mathematics, Self-Made*

INTRODUCTION

Mathematics is a core discipline that plays a pivotal role in both the academic achievement and practical solving of problems. However, most students suffer from poor understanding of mathematical concepts, which in turn bring gaps in their performance and engagement. Looking upon these challenges demands a systematic change in the light of learning needs in order to have continuous improvement.

The core skills in mathematics help students to develop critical thinking and problem-solving and analytical skills. Acquiring these foundational skills at mastery levels is very hard for many learners because of different prior knowledge, learning styles and classroom dynamics.

Anggreani, Lian, and Kesumawati (2020) defined modular instruction as a form of alternative instructional design that employs developed instructional materials tailored to the needs of students. They were encouraged to engage in a variety of engaging and challenging tasks to retain concentration and attention, thus promoting independent research. They were actively involved in understanding the concepts discussed in the module. They gained a sense of responsibility as they completed the tasks in the module. The students advanced on their own with little to no support from the instructor. They knew how to read and were given the tools to do so.

Teachers themselves become enthusiastic. Since, students have varied learning capacities, teachers who use modules can attend to different students who work on varied tasks. Monitoring students' activities can become more purposeful especially with students who need more guidance and attention. The modules allow them to be occupied with legitimate activities like preparing for another teaching task. The use of modules also strengthens the overlapping capacity of the teacher to attend to the varying needs of the students without compromising the quality of instruction. The teacher can monitor each student because the failure of the teacher to monitor independent work may mean incorrect learning by the students (Alea et al., 2020).

The mathematics and content teachers will be encouraged to make their own materials to facilitate the learning activities for independent study of the students. Working on these modules encouraged learners to work on assigned tasks independently with minimal supervision and guidance of the teacher to ensure that they learn correctly (Apino and Retnawati, 2020).

In recent years, the Philippines has faced a growing educational crisis, particularly in mathematics proficiency among learners. National assessments and international benchmarking studies consistently highlight the alarming state of Filipino students' performance in basic math. One of the most telling indicators came from the 2018 Programme for International Student Assessment (PISA), where Filipino 15-year-olds ranked second to the lowest in mathematics out of 79 countries. This finding was echoed in the 2019 Southeast Asia Primary Learning Metrics

(SEA-PLM), where only 17% of Grade 5 learners reached the minimum proficiency in mathematics expected at their level.

Teachers are enjoined to produce quality modules that will alleviate the rigors of preparation of daily activities, and will meet the need of teachers to prepare relevant materials for students to recognize their goals. Modules may serve as guidelines in setting goals in teaching content subjects by providing teachers the steps to follow in preparing materials that will realize the attainment of objectives of designed courses (Barokah and Saputro, 2020).

There are teachers' activities outside the school that decrease the quality time for students to learn numeracy. Various activities and teaching concerns like attendance in seminars, workshops and training lessen teachers' time in the classroom. Lessons are not delivered as planned because of interruptions beyond the control of the teacher. Modules prepared for the students, no learning time is lost since modules are ready for students to accomplish in the absence of the teachers (Bayod and Bayod, 2020).

More so, learners will benefit because they become independent and responsible doing their individual tasks with minimal supervision. As teachers raise their level of trust to students, the value of independence among the students will manifest in their lives. Their proficiency and competency will grow. The writing skills of students will also be developed through the language tasks provided in the modules. The use of the modules in the classroom will arm them with the necessary skills to express themselves better. Researchers of other disciplines may consider the findings of this study as a source to explore other aspects to be considered in future researches along with the preparation of other alternative instructional materials (Anggreani et al., 2020).

In the division of Davao Del Sur specifically in Santa Cruz South District, modular learning is being shifted during suspension of classes or other teachers' activities that affect the face to face learning of students. Being a Grade 6 mathematics teacher, it is alarming that students from this grade level are still experiencing difficulty in mastering basic operations in math. The researcher being a teacher in the above-mentioned public institution would like to explore how mathematics is taught through module-based instruction when majority find difficulty in mathematics subject.

LITERATURE REVIEW

Barokah and Saputro stressed the importance of learning mathematics as a science because it is a topic that fosters creativity and problem solving. Mathematics is divided into several branches: algebra, geometry, arithmetic, and analysis. As a result of problem-solving-oriented learning, pupils become accustomed to thinking mathematically, particularly logically, rationally, and critically (Barokah and Saputro, 2020).

Suryani, A.I., and Rofiki (2020) argued, however, that society continues to regard mathematics as a difficult and frightening subject. Effective learning can be observed through participation in different activities. Learning activities and self-directed learning are both examples of internal elements that might affect a student's achievement. Learning success will be determined by the student's own (internal) factors and efforts (Capuno et al., 2020).

As an agent in the planning process of learning, the mathematics teacher plays a critical role in organizing the learning process effectively and efficiently in module-based instruction. As Kurniawati and Saputro (2020) explain, teachers can utilize a variety of learning resources and media technologies to foster an atmosphere of active learning. Learning with media technology enables students to solve issues independently, increases students' comprehension of the subject offered, motivates students to learn with passion, and enables students to set their own pace of learning. As a result, it places a premium on teachers utilizing learning materials (for example, modules) that can support students in actively and autonomously participating in the learning process (Creswell, 2023).

Siregar, Rosli and Maat (2020) defined module in mathematics as a collection of study-related programs that includes resources, techniques, and evaluation and may be used independently. Some development of modules have been established in both higher education and secondary education. According to research conducted, the assisted learning software module simplifies the process for users because the program is employed in accordance with the Calculus II (Integral Calculus) characteristics to check complex calculations (Clarke et al., 2020).

Pişkin Tunç and Akrolu (2020) said that aided software modules in accordance with the features of matter triangle were used to visualize geometric objects on junior high school students. Scaffolding on learning triangle is offered manually in the study conducted by. However, as technology advances, educational media must adapt (Creswell, 2020).

According to Othman (2020), the module's quality is determined by its content, language, presentation, and graphics. Material elements include the material's alignment with the course's desired learning outcomes and competencies, the accuracy of the course's content, the material's utility in increasing knowledge, and the material's alignment with moral and social ideals (Denzin, 2022).

Aspects of language include readability of the language used, clarity of information, adhering to the standards of excellent and proper Indonesian writing, and the effective and efficient use of phrases. Presentation component involves the clarity with which the learning objectives are delivered in detail, the clarity with which the material is

presented, the presentation of the material accompanied by motivating words, attractiveness, interactivity, and completeness of information. Legibility of pictures and graphics is one of the graphic elements (Nabayra, 2020).

Module is a self-contained learning experience that is organized around a set of separate and coherent learning needs and evaluated using distinct criteria. Modules in mathematics are not textbooks. Characteristics of instructional resources that identified learning objectives, were arranged around flexible learning patterns, and were based around student requirements and competencies (Firdaus).

What seems to be alarming is the rising concern of students of the modules in mathematics. The main challenges that the students have encountered are self-studying, poor internet connection, lack of sleep and time to answer all the modules due to the great number of activities, distractions, and lack of focus. Baticulon, et al., emphasized that there are three main challenges in module-based teaching and learning. These are how to explain and present mathematics without person to person interaction, how to keep a record of student's homework and assignments in time and how to assess their knowledge in the end.

Ardo, in his study (2020), explores the problems that Grade 11 students in the Humanities and Social Sciences strand of Bestlink College of the Philippines face in solving mathematical problems under the General Mathematics subject. The study points out that, indeed, there are great problems encountered by these students that affect their academic performance. Student-Related Factors comprise the problem of inability to analyze the problem, the problem of visuals, and the problem of lack of understanding of concepts. Students find it problematic to break down problems into smaller manageable parts, thereby causing confusion and frustration.

The teachers sometimes fail to diagnose the capacity of their students' learning. Therefore, they might end up do the wrong approach in teaching. There is no individual support that can help make matters worse and demonstrate there is no hope to make things better for students. Lack of resources is also a problem. There is also a bad provision of learning materials that will result in inefficient books and technology that may fail students from achieving mathematical concepts and even performing solutions.
This led to the establishment of direct relationships between these challenges and students' performance in class. Poor performers in solving mathematics problems often face poor grades. Inability to explain and solve problems lower scores, which negatively impacts marks and grades. Repeated failure to solve problems can cause students to become low in confidence, reluctant to take part in class or become helpless. Those students who do feel overwhelmed by their problem-unsolving inability may start losing interest and become absent increasingly. This further worsens their conditions at school. Cooperation between teachers and students must be strengthened to fight out these problems.

Ardo et al. (2020) provided valuable insights into the difficulties faced by students in solving mathematical problems within the General Mathematics subject. The research emphasizes the importance of addressing these challenges through a multifaceted approach that involves teacher training, enhanced learning resources, and collaborative problem-solving strategies. By addressing these issues, educators can help students develop a stronger understanding of mathematics and improve their overall academic performance.

Prior knowledge of students is one aspect that needs to be focused which means the previous knowledge of the students towards mathematical contents is very important. The basic knowledge of mathematics in secondary level is the key factor which determined good performance of the learners. It is also determined student's performance in the further study. Mathematical pre-knowledge is the foundation and all round development of students in the mathematics subject. Those students who have lack of sufficient prior knowledge did not want to learn and could not get success in the further level. It is responsible for students fail in mathematics in all school secondary level. (International Journal of Elementary Education 2017)

Statement of the Problem
This study aimed to determine the effect of utilization of modules in mathematics on the basic mathematical operations particularly on grade 6 learners. Specifically, it answers the following sub-problems:

1. What is the pre-test mean scores of the experimental and control group of grade 6 learners?
2. What is the post- test mean score of the experimental and control group of grade 6 learners?
3. Is there a significant difference between the posttest of the experimental and control group?
4. What is the magnitude of effect of module based instruction on the basic mathematical skills of grade six learners?

METHODOLOGY

Research Design
This study used the quasi experimental research design which is a non-equivalent control group pretest-posttest design. Non-equivalent is a good design when the researcher has access to one group for experimentation (Vockel, 1983).

The researcher opted to use this design because the subject of the study were intact group of learners. On the other hand, quasi-experimental research design is widely used in social sciences, education, healthcare, and other fields to evaluate the impact of an intervention or treatment. It differs from real experimental designs in

that it lacks random assignment, which can limit control over external factors but still offers valuable insights into cause-and-effect relationships. The strength of quasi-experimental design is, it allows the researcher to study the real when randomization is impractical or unethical. While not as robust as true experiments, quasi-experimental designs still provide evidence of causality, helping to inform policies and practices and findings can often be applied to real-world settings, making them relevant for decision-making (Polit and Beck, 2017).

On the contrary, quasi-experimental research design differences between groups may influence results, reducing internal validity. External factors may impact outcomes, making it hard to establish a clear cause-and-effect relationship. Its finding may not always applicable to broader populations due to the lack of randomization and the presence of uncontrolled variables weaken the confidence in causal conclusions. In conclusion, quasi-experimental designs are valuable when true experiments are not feasible, so researchers must carefully consider their limitations to ensure meaningful and reliable results (Evans and Keenan, 2019).

Research Respondents

This study was conducted in Davao Del Sur particularly in Sta Cruz South District. The subjects of the study were the 50 grade 6 learners from one section. Learners in the control and experimental group were enrolled in one school of Santa Cruz South District this school year 2024-2025. The learners in this section were homogeneously mixed.

At the outset the 50 learners took the 35 – item pre-test which results were basis in determining which learners constituted the control group and who were assigned in the experimental group. Those learners which scores belonged to the top 25 in the test were in the control group and those learners whose scores comprise the second 25 were in the experimental group. Together, they took the test which topic focuses on the basic mathematical operations.

Research Instrument

This study utilized the researcher-made pre-test and post-test which was the tool to measure basic mathematical skills of learners. The test questions were checked and validated by experts. Consequently, the test was pilot tested to test its validity and reliability using cron bach alpha. Post-test was administered to measure the effect of innovation.

Data Analysis

The following statistical tools were used in the analysis and interpretation the responses in this study.

Mean was used to describe the research skills of the subjects from controlled and experimental groups in pre-test and post-test. Mean is a fundamental statistical measure used to describe the central tendency of a dataset. It is calculated by summing all the values in a dataset and then dividing by the total number of values (Mendenhall 2010).

t-test for uncorrelated samples was used to test the significance of difference between the pre-test and post-test mean scores in the experimental and n groups. t-test is a statistical method used to determine if there is a significant difference between the means of two groups. It helps researchers assess whether the observed differences are due to random chance or a true effect. The t-test is particularly useful when dealing with small sample sizes and unknown population variances.

Eta square was used to measure the magnitude of effect of the module-based instruction on the mathematical skills of grade six learners. Eta-squared is a statistical measure used to assess the effect size in analysis of variance (ANOVA). It quantifies the proportion of total variance in a dependent variable that is explained by an independent variable. The larger the eta-squared value, the greater the effect of the independent variable on the dependent variable.

RESULTS AND DISCUSSION

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Conclusions

Based on the findings on this study, the following conclusions are drawn: Pre-test mean scores of the controlled group is Developing, the pre-test score of the experimental group is Beginning, Post- test mean score of the control group is Developing, the post test mean score of the experimental group is Proficienct, the significant difference in the post-test scores between the control group vs. experimental group is Significant and the magnitude of the effect of module-based instruction on the mathematical skills of grade 6 learners is Very Large.

The following concepts justify the conclusion of this research. First is the Constructivist Learning Theory. This theory developed by Jean Piaget and Lev Vygotsky, stated that students construct knowledge actively through experience and activity. Module-based learning is in line with this theory by enabling students to study at their own pace, experiment with concepts through guided activities, and integrate new knowledge to previous knowledge, allowing greater understanding of mathematical concepts.

Furthermore, the Cognitive Load Theory by John Sweller stresses that learning happens better if instructional design avoids unnecessary mental effort and concentrates on substance. Well-structured modules assist in avoiiding cognitive overload by offering data in manageable ways, with the help of visual aids and step-by-step instructions to facilitate learning. This kind of instruction improves the ability of students to learn and retain mathematical data, resulting in enhanced problem-solving capacity and clarity in concepts. Taken together, these theories point to how module-based teaching generates a productive learning environment that facilitates the development of mathematical skills among Grade 6 students.

Recommendations

In the light of the findings drawn out by the researcher in this study, the following recommendations are offered:

The Department of Education (DepEd) should integrate and promote the use of module-based instruction in the teaching of mathematics at the elementary level, particularly in Grade 6. The positive effect of module-based instruction on learners' basic mathematical skills suggests that this approach can serve as an effective supplement or alternative to traditional classroom instruction. DepEd is encouraged to develop high-quality, learner-friendly modules that are aligned with the K–12 curriculum, incorporating clear instructions, engaging activities, and progressive problem-solving tasks. Additionally, teacher training programs should be enhanced to equip educators with the necessary skills to facilitate and monitor module-based learning effectively. To ensure equitable access, DepEd should also consider providing printed and digital versions of modules, especially in remote or underserved areas. Continuous monitoring and evaluation of the implementation of module-based instruction are essential to improve its effectiveness and to ensure it addresses the diverse needs of learners across different contexts.

To the School heads, school heads are encouraged to support the implementation and continuous improvement of module-based instruction in the teaching of mathematics, particularly in Grade 6. School leaders should ensure that teachers are provided with adequate resources, training, and time for the development and effective delivery of instructional modules. They are also advised to foster a culture of innovation and collaboration among teachers by facilitating regular learning action cell (LAC) sessions focused on sharing best practices in module development and usage. Moreover, school heads should monitor the progress of learners using module-based instruction through formative assessments and provide targeted interventions for students who may need additional support. By creating an enabling environment and providing strong instructional leadership, school heads can help maximize the positive impact of module-based instruction on learners' basic mathematical skills.

The teachers should adopt and enhance the use of module-based instruction to strengthen the basic mathematical skills of Grade 6 learners. Teachers should develop or adapt instructional modules that are aligned with curriculum standards, incorporate real-life applications, and provide scaffolded activities that cater to diverse learning needs. It is important for teachers to ensure that modules are clear, engaging, and appropriate for learners' developmental levels. Additionally, teachers should guide students in using the modules effectively by setting learning goals, monitoring their progress, and providing timely feedback and support. Regular assessment of student performance should also be conducted to identify learning gaps and adjust instruction accordingly. By actively engaging in the development and implementation of module-based instruction, teachers can create a more learner-centered environment that promotes mathematical understanding and academic growth.

For future researchers are encouraged to build upon the findings of this study by conducting further investigations on the effectiveness of module-based instruction across different grade levels, subjects, and learning environments. It is recommended that future studies explore the long-term impact of module-based learning on students' academic performance, critical thinking, and problem-solving skills. Researchers may also consider using a larger and more diverse sample size to increase the generalizability of results. Additionally, comparative studies between module-based instruction and other teaching strategies, such as blended learning or technology-integrated approaches, could provide deeper insights into the most effective methods for enhancing mathematical skills. Qualitative research

focusing on student and teacher experiences with module-based instruction may also offer valuable perspectives for improving the design and implementation of instructional modules.

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