

Students' Mathematics Achievement using Three-Tiered Instructional Model

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Abstract: *This study investigated the effectiveness of using Three-Tiered Instructional Model in enhancing students' achievement in mathematics. The participants were two (2) intact grade 8 class of Misamis Oriental General Comprehensive High School in school year 2019-2020. The experimental group of the study was taught using Three-Tiered Instructional Model having its attributes wherein Tier 1 is a core classroom instruction conducted by the teacher; Tier 2 is a targeted small group instruction through peer tutoring; and, Tier 3 is the intensive individual intervention through pair tutoring. For the control group, students were taught using the Three-Tiered Instructional Model with the following attributes: Tier 1 is still carry out by the teacher; Tier 2 is a conventional small group discussion facilitated by the teacher; and, Tier 3 is an individual intervention through remedial conducted by the teacher. Prior and after the experimental period, students were given a validated 26-item multiple choice test to measure students' achievement. Data collected were analyzed using mean, standard deviation and two-way analysis of covariance (ANCOVA). Results of the analysis revealed that students' achievement in mathematics improved when taught using the Three-Tiered Instructional Model. The attributes used in each tier for experimental group helped the students better in their mathematics performance than the attributes used in each tiers for the control group. Hence, the researchers recommended that mathematics teachers may employ Three-Tiered Instructional Model in teaching mathematics as it has a positive effect in improving students' mathematical achievement; provide enough opportunities to the performing students to solidify their learning; and, offer more chances to the least performing students to gain help in their difficulties. Furthermore, similar studies may be conducted for the better proper employment of the instructional model using different attributes in each tier and study how it can efficiently foster students' achievement in mathematics.*

Keywords: three-tiered instructional model, mathematics achievement, peer tutoring, pair tutoring, remedial teaching

1. Introduction

In the swift advances of today's demand in education, teachers are greatly challenged in improving student's mathematics performance. Rote learning is recurrently applied, hitherto it is insufficient. Factors that affect this mathematics learning have a lot of attention to focus. DepEd K-12 curriculum implemented the No Filipino Child is Left Behind Act 2010 to ensure that the students achieved important learning goals intended for their grade level. However, during the learning process where fifty or more students have different levels of understanding, the result falls short. DepEd recognizes the urgency of addressing issues and gaps in attaining the quality of basic education in the Philippines (San Juan, 2019).

In order to deal with this gap, students' need to be explicitly taught in a way that it can be transferred across various situation and perspective. Tambychik & Meerah (2010) added that there must be understanding on what is the occurring difficulty of the students, it could then provide a guide line for teachers to plan a better approaches and effective teaching methods for the development of a meaningful teaching learning process.

2. Theoretical Framework

European educator Comenius (1642) recognized that learning taught in schools is a thing too tedious, that things are not presented to the very eyes and hands of the learners. He then proceeded to recommend certain measures to rectify the situation and suggested to represent everything to its proper sense. This notion then is supported by various philosophers and psychologist that leads to various instructions.

In the early 1900s, Russian psychologist, Vygotsky, has paved the road for social constructivist learning theory. Vygotsky (1999) believed that everything is learned on two levels. First, it is through dealing with others, and then integrated into the individual's mental structure. In this theory, it supported the conduct of the study that students at first may encounter difficulty in the lesson since students vary from their understanding, but, through the support of other individual, particularly tutors, learning could thoroughly process that would result to individual development. Every function in the students' development appears twice: first, is on the social level, and later, on the individual level.

Vygotsky's Zone of Proximal Development helps understand between what a learner can do without help and what they can do with support. The basis of this theory states that instruction should be designed to reach a developmental level just above the student's current level because that is where learning takes place. In the experiment conducted, students were given a lesson fitted to their level of understanding. If learning was already achieved, mastery of it was showed through sharing to other person. On the other hand, if the lesson was not well obtained, it took another experience to encounter the same lesson, productively under adult guidance or in collaboration with more capable peers (Vygotsky, 1978).

Bruner's theory of scaffolding emerged around 1976 as a part of social constructivist theory of Vygotsky. As summarized by Wheeler in Teachthought (2017), Bruner believed that when a student starts to learn new concepts, they need help from teachers. It is a fact that learning is profoundly reliant on teachers. There is a must that a teacher

interprets the curriculum and selects good curricular strategies to be used in the learning process. As well as the teacher should not pre-assume that when the student receive firsthand lesson, one and all absorbs it. All of the students are given an equal chance of learning, but on the existence of low performing students, they need another option of active support. Gagne (1967), in his theory of acquisition of knowledge, believes that one important foundation of instruction is to establish a high recallability of the learning act. The most manipulative way to do this is not exact repetition of stimulus situation but rather presentation of additional examples and other capable support.

Another innovative approach in enhancing learning is by peer tutorial. Tutoring is found to be a good supplement in learning, it increases students' opportunity to interact with each other, thus, in the process, students' gain more confidence while engaged in a problem solving task. Scaffolding and peer support then are extensions of Vygotsky's notion. The learner will take pieces of their knowledge and organize them to make sense of what they know in answering activities and problems involving mathematics. Once the student has benefited the scaffolding, as they become more independent in their thinking and acquire new skills and knowledge, the support can be gradually faded until such time that a student has confidence to work independently.

In view of the theories presented, the researchers put together this theory to a study that delves on the concept of the Three-Tiered Instructional Model. Its design sought enhancement to student's Achievement in mathematics. Uniquely, different attributes were added to each tier to categorize its level.

3. Literature Review

Tiered Instruction and Intervention in a Response-to-Intervention by Shapiro (2014) represents a model in which the instruction delivered to students varies on several dimensions that are related to the nature and severity of the student's difficulties. Freeman-Green, Person, & Chris (2018) cited National Center on Response to Intervention (2010) that Tier 1 is an instruction that involves high-quality core instruction that meets the needs of most students, Tier 2 includes small group instruction and tier 3 is an individualized instruction with increased frequency to those students who are not demonstrating progress based on the previous interventions. When tiered instruction is implemented correctly, it can serve as a powerful preventative tool that supports at risk students. Additionally, Galloway (2018) in her study concluded that when Tier 1 instruction is strong, Tier 2 and Tier 3 will be effective, resulting in fewer students needing the extra support afforded in Tier 2 and Tier 3.

Robinson & Hutchinson (2014) cited Vaughn, Linan-Thompson and Hickman (2003) that using a tiered approach to instruction could help improve student's word attack, fluency, and comprehension. While these studies focused mainly on interventions related to reading, they further cited several studies that have shown that the tiered approach can be used also in any concepts or skills with which students

struggle, like teaching number sense, word problems, and mathematical operations.

According to Armstrong & Stephani (2010) when an instruction is tiered, acknowledge first that the content is appropriate for all students. Also acknowledge that to reach the learners, both the content and the methods of teaching must be adapted. Knowing the content, sequence of instruction, and proposed pacing is the first step. Using the level of need as a starting point, the goal is encouraging students to stretch beyond their current independent performance levels since there is a difference between what students can do on their own and what they can do with help.

From the study of Yaman (2019), he identified and understands the behavior of tutor and tutee to each other during peer tutoring. It was observed that tutors and tutees have three kinds of relationships. These are interdependence to each other, scaffolding one another, and tutoring. These relationships are dependent on the skills of the tutors and personality of the peers. Another important construct for peer learning is peer matching, with personality and skills as the most important elements are in the matching decision. The decision-maker must know the subjects, their capabilities, and their personalities. Well-matched pairings may increase learner's academic achievement.

Deb Russell (2019) shared helpful concepts for improving students' skills. One of it is teachers should organize a group or work in pairs or triads if their students are struggling to grasp the concepts on their own. In adult life, professionals often work through problems with others, and math doesn't have to be any different. A work buddy provides students with the opportunity to discuss how they each solved the math problem, or how one or the other did not understand the solution and these leads to permanent understanding. In the present study, the researcher will design a plan to effectively paired students.

Furthermore, the study of Donovan and Shepherd (2013) in Multi-Tiered Systems of Support in Mathematics from elementary and middle schools had Tier 1 that integrated the support of math interventionists, for Tier 2, students were given more individualized support by math interventionists in the classroom or were given supplemental small-group instruction that occurred outside of the classroom, and Tier 3 on more individualized time adjusted to the students' skill level. The results of their study recommend that the Multi-Tiered System model has potential to improve how math instruction is approached. Both of the schools involved in the study had made significant progress in improving mathematics instruction for students at all levels of learning. Additionally, it led to increase communication and collaboration among students and both reported seeing gains in instructors' responsiveness to students' individual needs, students' confidence and skill levels.

4. Methodology

The study utilized quasi-experimental pretest-posttest group design. This design involved two intact groups of students: one control group and the other one is experimental group which were subjected to Three-Tiered Instructional Model.

The experimental group was subjected to three tiered attributes namely Tier 1: Core Classroom Instruction conducted by the teacher. ; Tier 2: Targeted Small Group Instruction through pair tutoring; Tier 3: Intensive Individual Intervention through peer tutoring while the control group was subjected to three tiered attributes namely Tier 1: Core classroom Instruction conducted by the teacher; Tier 2: Conventional Small Group Instruction facilitated by the teacher; Tier 3: Intensive Individual Intervention through remedial conducted by the teacher.

In the implementation of the study, the experimental group observed the following method in the Three-Tiered Instructional Model: In Tier 1, the teacher does the presentation of the lecture and discussion of a given specific topic. The teacher made use of different strategies during the discussion like doing daily routines, warm up activities, board works, and exercises to encourage participation. It was then be followed by a formative test. The result of the formative test in tier 1 was used as one of the bases for the selection of tutors to those learners who got low scores and underwent Tier 2. The teacher will assign students to a tutor accordingly. Tutors were given a guide instruction and set of exercises for the tutoring activity. Lastly, Tier 3 was conducted through pair tutoring by a performing student towards a least performing student from the basis of their result in the formative test in tier 2. For the control group, the structures observed in the Three-Tiered Instructional Model of the experimental group were the same. It also had Tier 1 to Tier 3 and the formative test after each. However, in Tier 2, students will be in conventional small group discussion but tutors were not selected. The teacher gave an activity and enough time within the group for discussion. For Tier 3, remedial class was done by the teacher. The students in this tier were assessed individually based on their difficulties from the formative test in tier 2. The process continued throughout the duration of the study.

In measuring the students' achievement in mathematics, the two groups underwent a pretest before the start of the intervention and posttest at the end of the experimental period using a validated teacher made test. During the treatment, formative test to both groups used the K-12 rating system of the department of education to measure their attainment and for the basis for the next tier level. The study was conducted at Misamis Oriental General Comprehensive High School (MOGCHS). Two (2) intact heterogeneous classes of grade 8 students of School Year 2019-2020 were considered participants of this study. The class for experimental and control group were identified through draw lots in the presence of another teacher as witness.

The One-way Analysis of Covariance (ANCOVA) was used to determine the significant difference between the control and experimental group. ANCOVA was used for the samples since the two groups were intact. The pre-test served as covariate and the post-test for the criterion measure. Mean and Standard deviation were used to describe student's achievement in mathematics.

5. Results and Discussion

Table 1: Mean and Standard Deviation of the Students' Mathematics Achievement Scores

Groups	N	Mean	Pretest		Mean	Posttest	
			SD	Descriptive Level		SD	Descriptive Level
Control	45	7.87	2.473	Beginning	10.29	3.167	Beginning
Experimental	45	7.36	2.955	Beginning	16.89	3.967	Approaching Proficiency

Perfect Score: 26	Mean Score	Descriptive Level
	23 – 26	Advanced
	20 – 22	Proficient
	17 – 19	Approaching Proficiency
	12 – 16	Developing
	0 – 11	Beginning

Table 1 presents the mean scores and standard deviation of the pretest and posttest of both experimental and control groups in their mathematics achievement performance. During the pretest both groups were still at the beginning level of proficiency with the pretest mean score difference of only 0.51. This indicates that the levels of both group has a very close students' abilities in grade 8 mathematics. Moreover, the standard deviation differed 0.48 in favor to the experimental group. This indicates a wider dispersion in the scores of the students in the control group whereas the scores of the experimental group were closer to the mean. The experimental group signifies that some students got high and low scores in the pretest while the control group had almost similar scores in the pretest. However, given the small difference of the pretest standard deviation to both groups, it is safe to view that their ability to grade 8 mathematics is relatively close.

For the posttest, it can be observed that the control group still remained at the beginning level of proficiency whereas the experimental group improved to approaching level proficiency. This indicates that the achievement scores of the students in the control group still improved but did not reach the likely subsequent level. This shows that the students were developing their knowledge but basic skills were not yet been fully obtained to increase further understanding of the concepts. On the other hand, the experimental group obtained an approaching level of proficiency which means that the students developed minimal knowledge, fundamental skills, and core understanding of the concepts. The performance of the students in both groups improved during the posttest with a slight difference of 0.80 in the dispersion of their scores, but noticeable difference of 6.60 in their mean scores showed that experimental group progress better. This means that students who were exposed on the Three-Tiered Instructional Model using the attributes Tier 1: Core Classroom Instruction conducted by the teacher; Tier 2: Targeted Small Group Instruction through pair tutoring; Tier 3: Intensive Individual Intervention through peer tutoring improved better their mathematical ability compared to the Three-Tiered Instructional Model where group discussion and remedial were used as attributes for Tier 2 and 3.

Although both groups improved in their mathematics performance, pretest to posttest indicates that their responses were different. Considering that the control group remains at

a level of beginning, the students here are more homogeneous in their performance. It further employs that the students' scores in this group are close from each other. While in the experimental group, students' performance improved a lot better to approaching proficiency. Taking into consideration the dispersion of their scores, it indicates that some students become more certain in each tier; it helps them to progress and process information with the help of their tutors in increasing their scores in the test. In order to establish if the difference of scores is significant, further analysis was done using One-Way Analysis of Covariance (ANCOVA).

Table 2: One-Way ANCOVA Summary of the Students' Mathematics Achievement

Source	Df	Adj SS	Adj MS	F-Value	p-Value
Treatment Within	1	1067.44	1067.44	105.58	0.001*
Error	87	879.58	10.11		
Total	88	1947.02			

*significant at $p < 0.05$ alpha level

Table 2 shows the result of the One-Way Analysis of Covariance of the students' mathematics achievement scores in grade 8 mathematics between the control and experimental group. The analysis yielded a p-Value of 0.001, that is, less than the 0.05 level of significance. This indicates that there is a significant difference in students' mathematics achievement when taught using the different Three-Tiered Instructional Model.

Based on the result, Three-Tiered instructional Model having the attributes of Tier 1: Core Classroom Instruction conducted by the teacher; Tier 2: Targeted Small Group Instruction through pair tutoring; Tier 3: Intensive Individual Intervention through peer tutoring helps the students to obtain more elevated scores. The tiers in this group intensify students understanding in their lesson and the skills it requires.

6. Conclusions and Recommendations

The researchers concluded from the findings of the study that Three-Tiered Instructional Model improved students' achievement in mathematics. The use of Three-Tiered Instructional Model having the attributes of Tier 1: Core Classroom Instruction conducted by the teacher; Tier 2: Targeted Small Group Instruction through pair tutoring; Tier 3: Intensive Individual Intervention through peer tutoring helped better than the Three-Tiered Instructional Model using the attributes of Tier 1: Core classroom Instruction conducted by the teacher; Tier 2: Conventional Small Group Instruction facilitated by the teacher; Tier 3: Intensive Individual Intervention through remedial conducted by the teacher in enhancing students' mathematics achievement.

Based on the foregoing findings and conclusions of the study, the researchers' recommendations were forwarded that mathematics teachers may employ Three-Tiered Instructional Model in the teaching mathematics; encouraged to utilize peer and pair tutoring as attributes in the tiers; provide enough opportunities to the performing students to

become tutors as it enhances and solidify their learning; and, offer more chances to the least performing students to gain help in a way that they can express their difficulties to others. Furthermore, similar studies may be conducted to a wider scope in order to improved employment of the instructional model using a different attributes in each tier and study how it can efficiently foster students' achievement in mathematics.

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