PEOPLE: International Journal of Social Sciences
ISSN 2454-5899

Yazon & Leonano, 2019

Volume 5 Issue 2, pp. 729-747

Date of Publication: 27th September 2019

DOI- https://dx.doi.org/10.20319/pijss.2019.52.729747

This paper can be cited as: Yazon, A. D., & Leonano, A. V., (2019). Effectiveness of Mathematics Intervention Program (MIP) among Primary School Teachers. PEOPLE: International Journal of Social Sciences, 5(2), 729-747.

EFFECTIVENESS OF MATHEMATICS INTERVENTION PROGRAM (MIP) AMONG PRIMARY SCHOOL TEACHERS

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Abstract

This one group pretest-posttest study examined the effectiveness of Mathematics Intervention Program (MIP) among 34 primary school teachers in Laguna, Philippines. Teacher's competency in teaching Mathematics was measured in terms of content knowledge, teaching skills, material organization and presentation, management of learning environment, and teaching attitude. Meanwhile, teacher's performance were gauged through pre-test, formative test, and post-test which contained the lessons on integers, decimals, fractions, power roots, algebraic expression and equation, measurement, and reasoning. The results showed that before the implementation of MIP, all teachers-participants were evaluated as less competent in teaching mathematics. Their performance based on pre-test results was also poor prior the MIP. During the conduct of this study, the primary school teachers obtained a satisfactory rating in their formative tests which advocated that the intervention program was helping them in improving their craft. The post-test result also marked an improvement in their competence and performance in teaching mathematics. Hence, the researchers concluded that the mathematics intervention program was effective in

enhancing the pedagogical content knowledge among primary school teachers in mathematics. A more comprehensive study regarding teachers' competencies and classroom performance may be conducted in the light of professional development and qualification standards for Mathematics teachers.

Keywords

Pedagogical Content Knowledge, Mathematics Intervention Program, Teacher Competence

1. Introduction

Mathematics is not only the mother of all science but also the foundation of all scientific research. Mathematics, including the use of abstraction and logical reasoning, the calculation of numbers, and the analysis of things changed rules, is often described as a formal science that studies concepts using symbolic language. Today, mathematics is spanning various sciences and applies in many professions and disciplines. In common with every other discipline, people learn to think mathematically by being in the presence of others who are thinking mathematically, whether through reading written texts or through attending live lectures and participating in support groups (Hu, et.al., 2018).

However, based on NEDA report on education, teacher qualifications in the public schools remained to be an issue, both regarding content and pedagogy. What is alarming is even for teachers who are math specialists, their level and quality of subject competency is also wanting. (NEDA-MTPDP, 2004- 2010).

Much of the early research on the effectiveness of mathematics teaching focused on teacher knowledge of mathematics (Thompson, 2004). Teachers' beliefs about mathematics, mathematics learning and mathematics instruction can also impact on teachers' instructional practices (Wilkins, 2008), although the contextual nature of beliefs means that it is unwise to expect consistent links between beliefs and practice.

In the recent study of Ferrer (2017), the mathematics teachers assessed themselves as competent to teach Grade 10 Mathematics regarding content and pedagogy. However, among the eight competence on the content of Grade 10 mathematics, they still need additional in-service training on the topics Probability of Compound Events and Permutations and Combinations.

On the other hand, classroom instruction is accepted as a central component for understanding the dynamic processes and the organization of students' mathematical thinking and learning (Cai, 2004). Because classroom instruction plays such a central role in students' learning,

researchers have long tried to characterize the nature of the classroom instruction that maximizes students' learning opportunities. Teachers are central to classroom instruction in mathematics and have a major impact on students' learning. Consequently, if our aim is to improve students' learning of mathematics, one fruitful line of endeavor is to investigate the characteristics of effective mathematics teaching.

The components of teaching competence of mathematics teachers encompasses content knowledge (SEI-DOST & MATHTED, 2011) and the following skills: material's organization and presentation; learning environment created between students and teachers; and the teacher's teaching attitudes. SEI-DOST & MATHTED (2011) also added that in order to maintain a suitable learning atmosphere in the classroom, mathematics teachers must have sufficient knowledge in managing the classroom, the available resources in the classroom and in school and students.

In this premise, the researchers are prompted to implement Mathematics Intervention Program (MIP) for primary teachers. The content of the MPI was based on the result of the assessment of teacher competencies in teaching Mathematics. Thereafter, the MIP was utilized and its effectiveness in enhancing teacher's competency was determined.

The procedures to be used in the implementation of the MPI was aligned to the objectives of LAC policy: to improve the teaching-learning process that will lead to improved learning among the students and to enable teachers to support each other to continuously improve their content and pedagogical knowledge, practice, skills, and attitudes (DepEd Order No. 35, s. 2016, 10.1, 10.3).

1.1 Research Objectives

The study aimed to determine the effectiveness of Mathematics Intervention Program (MIP) among primary teachers in Calamba Elementary School. It specifically sought answers to describe the profile of the primary teachers in Calamba Elementary School in terms age, sex, highest educational attainment, and specialization; the observed assessment of teacher's competency in teaching Mathematics, before and after they participated in MIP, in terms of Content Knowledge, Teaching Skills, Material Organization and Presentation, Management of Learning Environment, and teaching Attitude; and the Mathematics teachers mean scores in the administered pre-test, formative and post-test assessment.

1.2 Scope of the Study

The study implemented the Mathematics Intervention Program (MIP) and determine its effectiveness among primary teachers. The program is composed of ten (10) interventions aiming to improve teaching competencies in early grade mathematics. The study was conducted in Calamba Elementary School. A second largest public elementary school in the Schools Division of Calmaba City. It covered the teachers in the primary grade level.

The implementation of Mathematics Intervention Program (MIP) for primary teachers was done through a series of school-based Learning Action Cell (LAC).

The teachers' competency in teaching Mathematics was assessed and the pretest and posttest assessment were administered prior and subsequent to the program implementation. An evaluation was given in every session to monitor the teachers' progress.

The evaluation instrument in measuring teachers' competency in teaching Mathematics focused on content knowledge, teaching skills; the material's organization and presentation; the learning environment created between students and teachers; and the teacher's teaching attitudes.

1.3. Gap Identification

There is a limited study on Mathematics Intervention Program (MIP) designed to help mathematics teachers to improve their competencies in teaching mathematics. To fill in this gap, the researchers executed coaching and mentoring functions and integrated the MIP in school-based Learning Action Cell (LAC) sessions.

2. Materials and Methods

The study attempted descriptive-quantitative and quasi-experimental research approaches.

According to Burns and Grove (2005), the descriptive-quantitative research method is used to describe variables; to examine relationships among variables; to determine cause-and-effect interactions between variables. Therefore, it became appropriate in determining and analysing the profile of teachers and the observed competency in teaching Mathematics.

Meanwhile, according to Shadish, Cook, & Campbell (2002), one of primary reasons in using quasi-experimental design is to evaluate the effectiveness of an intervention when the intervention has been implemented by educators prior to the evaluation procedure having been considered. It is applicable to the present study since its main objective is to determine the effectiveness of Mathematics Intervention Program (MIP) in improving the competency of teachers in teaching Mathematics.

Specifically, the study utilized One-Group Pretest - Posttest Design, a type of quasi-experiments that measured one group with a pretest, implemented a treatment manipulation, and then measured the same variable, as was measured with the pretest, with a posttest (Cohen, Manion, & Morrison, 2007).

Two sampling techniques were involved in this study, convenient sampling and total enumeration. Convenient sampling was applied in the selection of participating school. Therefore, it is most convenient to the researcher to conduct her study and implement the Mathematics Intervention Program for Teachers in Calamba Elementary School, where the researcher is practicing her functions as coach and mentor as a designated Master Teacher. Total enumeration was applied in the selection of all the primary grade teachers in Calamba Elementary School to participate in the study.

The main instrument of the study is a two-part survey questionnaire which was used to gather information regarding the profile of the respondents and the observed teacher's competence in teaching mathematics. The first part of the instrument contained items that required the respondents supply the information that apply to them. Particularly, this included the following profiles: age, sex, educational attainment, and specialization.

The second part is on teachers' observance of their competence in teaching mathematics. This is a combination of adopted/modified from sources. The items of teacher's competence on content knowledge was an adaptation of SEI-DOST & MATHTED's (2011) "Matrix of content emphases in the K to 6 Mathematics Curriculum that Mathematics Teachers Should Know". This contained content knowledge in number sense; measurement; geometry; patterns, functions, and algebra; and data, analysis and probability. Meanwhile, the items of teacher's competence on teaching skills, material organization and presentation, management of learning environment, and teaching attitude were modified from Leou's (1998) "Teaching Competency Assessment Items for School Mathematics Teachers".

Meanwhile, the instruments used in measuring the teacher's performance were the adapted/modified pre-test, formative test, and post-test. The contents of these assessment test were drawn from each topic of Mathematics Intervention Program (MIP) namely: Integers; Representing and Renaming Whole Numbers; Ordering Whole Numbers; Representing and Comparing Decimal; Multiplying and Dividing; Fractions; Relating Situations to Mathematical Operations; Power Roots, Algebraic Expression and Equation; Measurement- Volume and Surface Areas; and Proportional Reasoning.

The mean and standard deviation were utilized in determining the observed teacher's competency in teaching Mathematics. Dependent t-test was performed in determining the significant difference in the teachers' observed competence in teaching Mathematics before and after their participation in Mathematics Intervention Program. The same formula was performed in analyzing significant difference between the pre-test and post-test performance of the teachers.

3. Results and Discussion

Among the primary grade Mathematics teachers, there are 15 or 33% whose ages are between 31 to 40 years old. The 11 or 32% of the respondents are aged within bracket of 21 to 30 years old while two (2) are aged within bracket of 51 to 60 years old. There are six (6) or 18% whose ages are between 41 to 50 years old.

The findings showed that the population of Mathematics teachers in primary grades belonging to younger generation. Similar findings were revealed by Ferrer (2017) describing Grade 10 Mathematics teachers are in their 30's and 40's which denotes that they are still young in the teaching profession. This is due to the annual increase in enrolment resulting in the need for additional items for teachers, a majority of them are still young in the teaching profession (Ferrer, 2015).

All the 34 or 100% of the primary grade Mathematics teachers are female. Indeed, the teaching profession is female-dominated. This result is similar to the study of Lopez, as cited in cited in Mariñas (2012) wherein the female teachers outnumbered the males. In his discussion, he stressed that women dominate the teaching profession. He further stated that this is not because, statistically, there are more women than men, but this would be attributed to the two major reasons, namely: "the notion that the teaching profession is a woman's domain" and "the low economic returns".

Most (21 or 62%) of primary grade Mathematics teachers hold the degree Bachelor of Elementary Education (BEED) while the remaining 13 or 38% has complete academic requirements (CAR) for the degree Master of Arts in Education. The findings showed that only few Mathematics teachers in the locale of the study are pursuing their graduate studies. This is indeed opposes the fact, as posited by Ferrer (2015), that with the advent of globalization and competition, this young generation of teachers is more aware of the need to grow professionally.

Most (33 or 97%) of primary grade Mathematics teachers specialized in General Education while one (1) or 3% of them specialized in English. The findings indicate that teachers in elementary schools are generalists. This is attributed to the teacher education curriculum where there is no specialization being offered in BEED. Teachers not teaching their specialization or misallocation of teachers in the public schools remained to be an issue. Teachers who specialized in mathematics or had it as a major subject have the advantages of both content and pedagogical knowledge since such knowledge is acquired during teacher training programme. Blömeke & Delaney (2012) affirmed that teachers whose field of study was not mathematics have insufficient content and pedagogical knowledge to be able to deliver mathematics lessons.

The succeeding tables and discussions described the Master Teachers' mean assessment of teacher – respondent's competency in teaching Mathematics before and after their participation in Mathematics intervention program.

Table 1: *Teachers' Content Knowledge Competency in Teaching Mathematics before and after the Mathematics Intervention Program*

Indicative Statement	**Before**			**After**		
the teacher has knowledge of:	**Mean**	**SD**	**DI**	**Mean**	**SD**	**DI**
1. numbers sense						
1.1. describing correctly the structure and properties of complex numbers: real numbers	2.09	0.29	LC	4.12	0.41	C
1.2. solving problems involving these numbers	2.09	0.29	LC	4.12	0.41	C
1.3. posing problems involving these numbers	2.09	0.29	LC	4.12	0.41	C
1.4. making correct conjectures based on observed numerical patterns and relationships, and verifying results	2.09	0.29	LC	4.12	0.41	C
1.5. proving fundamental theorems involving numbers	2.09	0.29	LC	4.12	0.41	C
Overall	**2.09**	**0.29**	**LC**	**4.12**	**0.41**	**C**
2. Measurement						
2.1 defining the different terms in measurement and describing the attributes of each: length, mass, weight, time, temperature; perimeter, circumference, area, surface area, volume, angle measurement, scales, rate, speed, velocity;	2.09	0.29	LC	4.03	0.17	C
2.2 deriving the formula for perimeter, area, volume, and surface area of various shapes and solids;	2.12	0.33	LC	4.03	0.17	C
2.3 describing and comparing mathematical and real-world objects using well selected and appropriate units and tools;	2.09	0.38	LC	4.03	0.17	C
2.4 solving problems involving these measurement ideas;	2.09	0.38	LC	4.03	0.17	C
2.5 posing problems involving these measurement ideas;	2.09	0.38	LC	4.03	0.17	C
2.6 making conjectures on measurement.	2.09	0.38	LC	4.03	0.17	C
Overall	**2.09**	**0.34**	**LC**	**4.03**	**0.17**	**C**
3. Geometry						
3.1. describing properties and relationship relationships of basic concepts in the axiomatic Euclidean geometry (points, lines, planes and angles);	2.06	0.42	LC	4.03	0.17	C
3.2. using appropriate objects or manipulative materials to represent geometric terms;	2.06	0.42	LC	4.03	0.17	C

3.3. demonstrating geometric connections;	2.09	0.38	LC	4.03	0.17	C
3.4. describing properties of plane and solid figures;	2.12	0.41	LC	4.03	0.17	C
3.5. free-hand drawing of geometric figures based on a given description;	2.09	0.38	LC	4.03	0.17	C
3.6. constructing geometric figures based on a given description using a compass;	2.06	0.34	LC	4.03	0.17	C
3.7. classifying attributes of different kinds of shapes;	2.12	0.41	LC	4.03	0.17	C
3.8. demonstrating the use of algebra to verify the properties of plane and solid figures;	2.06	0.34	LC	4.03	0.17	C
3.9. solving and posing problems involving geometric figures;	2.06	0.34	LC	4.03	0.17	C
3.10. proving theorems involving geometric concepts using inductive and deductive reasoning;	2.03	0.39	LC	4.03	0.17	C
3.11. making conjectures about properties of shapes including transformations and combinations of shapes, and verifying these conjectures.	2.03	0.39	LC	4.03	0.17	C
Overall	**2.07**	**0.36**	**LC**	**4.03**	**0.16**	**C**
4. Patterns, Functions, and Algebra						
4.1. solving equations and inequalities;	2.06	0.34	LC	4.03	0.17	C
4.2. solving mathematical problems based on real world situations, which include non-routine problems;	2.09	0.38	LC	4.03	0.17	C
4.3. posing algebraic problems based on real world situations;	2.09	0.38	LC	4.06	0.24	C
4.4. using different representations and models of a given real world situation;	2.18	0.39	LC	4.06	0.24	C
4.5. recognizing patterns and making conjectures based on these observed patterns using functions;	2.15	0.36	LC	4.06	0.24	C
4.6. proving properties of equations and inequalities;	2.12	0.41	LC	4.06	0.24	C
4.7. working with all types of functions (e.g., algebraic and non-algebraic)	2.06	0.42	LC	4.06	0.24	C
Overall	**2.11**	**0.34**	**LC**	**4.05**	**0.21**	**C**
5. Data, Analysis and Probability						
5.1. demonstrating skills of collecting, organizing, reading, representing and interpreting data;	2.09	0.38	LC	4.06	0.24	C
5.2. describing terms in counting techniques and probability;	2.09	0.38	LC	4.06	0.24	C
5.3. solving problems involving the measures of central tendencies, and measures of dispersions;	2.09	0.38	LC	4.06	0.24	C
5.4. making predictions about outcomes and verifying these predictions using intuitive approaches.	2.09	0.38	LC	4.12	0.33	C
Overall	**2.09**	**0.38**	**LC**	**4.07**	**0.24**	**C**

Legend: SD - Standard Deviation: DI - Descriptive Interpretation
4.50-5.00 Highly Competent (HC); 3.50-4.49 Competent (C); 2.50-3.49 Moderately Competent (MC); 1.50-2.49 Less Competent (LC); 1.00-1.49 Not Competent (NC)

Table 1 reveals that based on Master Teachers' assessments, all the indicative statements as well as their overall mean of 2.09; SD=0.29 manifested that before their participation in Mathematics Intervention Program (MIP), the Mathematics teacher respondents were less competent in teaching the content knowledge regarding number sense, measurement, and data analysis and probability. Teachers were also assessed as less competent on the content knowledge of Patterns, Functions, and Algebra and geometry.

Meanwhile, after the teachers' participation in MIP, the Master Teachers assessment of their competencies on content knowledge yielded that they became competent on all the following sub-dimensions of content knowledge: number sense; data analysis and probability; Patterns, Functions, and Algebra; measurements; and geometry.

The findings implied that before their participation in MIP, the teachers were notably less competent on the content knowledge of proving theorems involving geometric concepts using inductive and deductive reasoning; making and verifying conjectures about properties of shapes including transformations and combinations of shapes. However, teachers became competent on this content knowledge and most notably in numeracy and in making predictions about outcomes and verifying these predictions using intuitive approaches.

The next table is the presentation of the Master Teachers' assessments of Mathematics teachers' teaching skills competency before and after their participation in MIP.

Table 2: *Assessed Teaching Skills Competency of Mathematics Teachers before and after the Mathematics Intervention Program*

Indicative Statement	**Before**			**After**		
The teacher	**Mean**	**SD**	**DI**	**Mean**	**SD**	**DI**
1. Clearly point outs the learning objectives and procedures for each topic to students by:						
1.1. presenting clear learning objectives before teaching.	2.41	0.50	LC	4.53	0.51	HC
1.2. telling the main learning procedures for topics to the students.	2.41	0.50	LC	4.56	0.50	HC
1.3. stating the purpose and contents of each topic to the students.	2.41	0.50	LC	4.59	0.50	HC
2. Chooses proper teaching strategies which will help students grasp the mathematics concepts by:						
2.1. applying effective teaching strategies reflecting different contents and features.	2.44	0.50	LC	4.59	0.50	HC
2.2. applying proper teaching strategies related to students' learning ability and understanding.	2.44	0.50	LC	4.59	0.50	HC
3. Leads students into some deep thinking by:						
3.1. giving proper questions to students leading to clear thinking.	2.41	0.50	LC	4.59	0.50	HC
3.2. using related materials to help them do positive thinking.	2.41	0.50	LC	4.59	0.50	HC
3.3. offering thinking process to help students do mathematics creation	2.38	0.49	LC	4.59	0.50	HC
4. Explains students' misconception at right time by:						
4.1. giving clear explanations when students misunderstand.	2.38	0.49	LC	4.59	0.50	HC
4.2. clarifying the confusing ideas for students	2.38	0.49	LC	4.59	0.50	HC
5. Applies teaching activities effectively by:						
5.1. arranging the procedure and pace for each class.	2.38	0.49	LC	4.62	0.49	HC
5.2. matching the teaching situation and arrange the order of activities.	2.38	0.49	LC	4.65	0.49	HC
5.3. giving a complete conclusion when a topic has been completely taught	2.38	0.49	LC	4.65	0.49	HC
6. Evaluates teaching assessment in each period to make a necessary change to meet the learner's ability by:						
6.1. understanding students' backgrounds through proper evaluation before teaching.	2.38	0.49	LC	4.65	0.49	HC
6.2. giving a quiz to test learner's understanding during the teaching proceedings.	2.38	0.49	LC	4.62	0.49	HC
6.3. giving a complete exam at the end of a finished lesson.	2.38	0.49	LC	4.59	0.50	HC
7. Be able to express ideas clearly by:						
7.1. using the right terms indicating the concepts of mathematics.	2.32	0.47	LC	4.59	0.50	HC

7.2. giving lectures in a logical order.	2.32	0.47	LC	4.59	0.50	HC
7.3. teaching lessons with normal speed and voice.	2.32	0.47	LC	4.59	0.50	HC
8. Have good board-writing skills by:						
8.1. drawing correct charts and graphics for teaching purposes.	2.35	0.49	LC	4.59	0.50	HC
8.2. being responsible for neat writing.	2.35	0.49	LC	4.59	0.50	HC
8.3. arranging board management.	2.38	0.49	LC	4.62	0.49	HC
Overall	**2.38**	**0.46**	**LC**	**4.60**	**0.45**	**HC**

The assessment performed by the Master Teachers, as reflected in Table 2, yielded an overall mean of 2.38 (SD = 0.46). This shows that the Mathematics teachers are less competent in the demonstration of teaching skills before they participated in the MIP. Meanwhile, bearing an overall assessment of 4.60 (SD=0.45) of the Master Teachers after the MIP, the teachers became highly competent in demonstration of their teaching skills in Mathematics.

The findings denote that before the teachers participate in MIP, they were less competent, notably on their ability to express ideas clearly, particularly in using the right terms in indicating the concepts of mathematics; in giving lectures in a logical order; and in teach lessons with normal speed and voice. However, they became highly competent in practicing their skills in teaching after they participated in the MIP. However, after they participated in the MIP, the teachers earned highly competent skills especially in matching the teaching situation and arrange the order of activities; in concluding a topic/lessons; and in understand students' backgrounds through proper evaluation before teaching.

The next table reveals the Master Teachers' assessment of teacher respondents' competency in teaching Mathematics before and after their participation in Mathematics intervention program in terms of materials organization and presentation.

Table 3: *Assessed Teachers' Competency in Materials Organization and Presentation in Teaching Mathematics before and after the Mathematics Intervention Program*

Indicative Statement	**Before**			**After**		
The teacher	**Mean**	**SD**	**DI**	**Mean**	**SD**	**DI**
1. Plans proper contents and good organization, like:						
1.1. arranging the proper materials in order to create students' cognition and learning ability.	2.38	0.49	LC	4.68	0.47	HC
1.2. making a well-organized lesson plan.	2.38	0.49	LC	4.71	0.46	HC
2. Presents lectures effectively by:						
2.1. instructing contents correctly.	2.38	0.49	LC	4.74	0.45	HC
2.2, giving hand-outs to enhance students' understanding.	2.38	0.49	LC	4.74	0.45	HC
2.3. applying media and material effectively	2.35	0.49	LC	4.74	0.45	HC
3. Helps students understand the connection and application of mathematics, like:						
3.1. understanding the connection between math concepts.	2.35	0.49	LC	4.74	0.45	HC
3.2. stressing the connection between math and other disciplines.	2.35	0.49	LC	4.74	0.45	HC

3.3. stressing the application of math to life.	2.35	0.49	LC	4.74	0.45	HC
4. Arranges proper assignments and evaluation, like:						
4.1. arranging proper assignments according to content and students' learning.	2.35	0.49	LC	4.74	0.45	HC
4.2. evaluating assignments properly according to content and students' learning	2.32	0.47	LC	4.71	0.46	HC
Overall	**2.36**	**0.48**	**LC**	**4.72**	**0.44**	**HC**

As gleaned in table 3, the assessment performed by the Master Teachers yielded an overall mean of 2.36 (SD=0.48) and 4.72 (SD=0.44) which respectively showed that the Mathematics teachers were less competent in materials organization and presentation before they participated in the MIP but gained high competent performance on it, thereafter.

The less competency in materials organization and presentation before the Mathematics teachers' participation in the MIP is notably attributed to their poor practices of evaluating assignments which mostly not according to content and students' learning.

The findings of the present study are supported by Nambira (2016), where classroom observations results revealed that teachers were not actively engaged in preparation of teaching materials. His study also reveals that a serious shortcoming on mathematics teaching in schools falls on the assessment and evaluation of learners. Teachers in many of the observed classrooms were not competent in assessing learners.

The next table presents the Master Teachers assessment of Mathematics teacher respondents' competency on the management of learning environment before and after their participation in Mathematics Intervention Program (MIP).

Table 4: *Assessed Teachers' Competency in the Management of Learning Environment before and after the Mathematics Intervention Program*

Indicative Statement	**Before**			**After**		
The teacher:	**Mean**	**SD**	**DI**	**Mean**	**SD**	**DI**
1. Creates a positive learning environment by:						
1.1. arranging best situations for students' learning. 1.2. decorating the teaching environment to reflect different topics.	2.38	0.49	LC	4.76	0.43	HC
1.3. stimulating student's learning motivation with proper teaching skills.	2.38	0.49	LC	4.76	0.43	HC
1.4. building student's learning confidence with proper teaching skills.	2.35	0.49	LC	4.79	0.41	HC
2. Builds two-way communication between teachers and students by:						
2.1. encouraging students to express their ideas through asking them questions.	2.38	0.49	LC	4.82	0.39	HC
2.2. letting students participate in teaching activities.	2.38	0.49	LC	4.82	0.39	HC
2.3. allowing students work in pairs and cultivate their discussing abilities.	2.38	0.49	LC	4.82	0.39	HC

2.4. giving students clear responses from their reflections or feedback.	2.38	0.49	LC	4.82	0.39	HC
Overall	**2.38**	**0.49**	**LC**	**4.80**	**0.39**	**HC**

The assessments performed by the Master Teachers, as reflected in Table 4, showed that all the indicative statements as well as their overall mean of 2.38; SD=0.49 manifested that before their participation in Mathematics Intervention Program (MIP), the Mathematics teacher respondents were less competent on the management of learning environment.

Meanwhile, after the teachers' participation in MIP, the Master Teachers assessments of their management of learning environment yielded an overall mean of 4.80 (SD=0.39) which shows they became highly competent on it along with all its indicators.

Pana and Escarlos (2017) explained that instructional activities emphasize on lower order thinking which settles only on recalling factual information. Activities that developed higher order thinking skills were not given emphasis due to teaching competencies on the use of the strategies. With the type of the students in the school today it is observed that they are technologically influenced as well as they are mentally and physically active.

The next table presented the Master Teachers' assessment of Mathematics teacher respondents teaching attitude before and after their participation in Mathematics Intervention Program.

Table 5: *Assessed Teachers' Competency before and after the Mathematics Intervention Program as Regards to Teaching Attitude*

Indicative Statement	**Before**			**After**		
The teacher:	**Mean**	**SD**	**DI**	**Mean**	**SD**	**DI**
1. Displays teaching enthusiasm by:						
1.1. teaching with professional confidence.	2.47	0.51	LC	4.82	0.39	HC
1.2. teaching with a warm heart.	2.47	0.51	LC	4.82	0.39	HC
1.3. teaching with enthusiastic attitudes`	2.47	0.51	LC	4.82	0.39	HC
2. Shows self-reflections on teaching method by:						
2.1. accepting students' comments and suggestions.	2.47	0.51	LC	4.82	0.39	HC
2.2. improving teaching methods based on the teaching assessment.	2.47	0.51	LC	4.82	0.39	HC
2.3.: improving teaching methods through self- reflective thinking.	2.47	0.51	LC	4.82	0.39	HC
Overall	**2.47**	**0.51**	**LC**	**4.82**	**0.39**	**HC**

As shown in Table 5, based on Master Teachers' assessments, all the indicative statements as well as their overall mean of 2.47; SD=0.51 manifested that before their participation in Mathematics Intervention Program (MIP), the Mathematics teacher respondents were less competent in displaying teaching enthusiasm and self-reflection on teaching method.

Meanwhile, after the teachers' participation in MIP, the Master Teachers assessments of their teaching attitude yielded an overall mean of 4.82 (SD=0.39) which shows they can be highly competent in practicing teaching attitude in Mathematics classroom.

By implication, therefore, the way the teacher sees and responds to the profession especially in the classroom or his attitude could have great influence on the effectiveness of his teaching.

This situation calls for an intervention strategy that could change their attitudinal orientation towards the teaching profession as it could be a first step towards making them become effective teacher that could impact on their students positively (Achor and Duguryil, 2012)

The following tables and discussions are about the results of Mathematics teachers mean scores obtained from the administered pre-test, formative tests, and post-test. mean scores before, during, and after the Mathematics Intervention Program respectively.

As shown in the table, the Mathematics teachers obtained a mean score of 22.15 (SD=2.23) from the administered pre-test. The skewness, which is equivalent to 0.36 described that most of the teachers obtained mean scores lower than the mean but not more than equal the obtained minimum scores of 18 points out of 40-item test.

Table 6: *Mathematics Teachers Means Scores obtained from the administered Pre-test, Formative Tests, and Post-test*

Test	Min	Max	Mean	SD	Skewness
Pre-test	18	28	22.15	2.23	0.36
Formative 1	15	19	17.09	1.11	-0.61
Formative 2	15	19	17.09	1.11	-0.61
Formative 3	15	19	17.09	1.11	-0.61
Formative 4	15	19	17.09	1.11	-0.61
Formative 5	15	19	17.09	1.11	-0.61
Formative 6	18	20	19.12	0.91	-0.24
Formative 7	15	19	17.21	1.09	-0.58
Formative 8	15	19	17.24	1.13	-0.50
Formative 9	15	19	17.09	1.11	-0.61
Formative 10	18	20	19.12	0.91	-0.24
Post-test	30	38	33.06	2.27	0.22

Meanwhile, the obtained mean scores in the given formative tests ranged from 17.09 to 19.12. The skewness of the obtained score in each formative test yielded negative decimal values which indicates that there is a greater number of teachers who obtained scores greater than the corresponding mean score of each formative test but less than equal their respective maximum scores.

However, the Mathematics teachers obtained a mean score of 33.06 (SD=2.27) from the administered post-test. The skewness, which is equivalent to 0.22 described that a greater number of teachers obtained scores higher than the obtained mean scores but less than equal the maximum scores of 38 points out of 40-item test.

The result of the pretest suggests that the mathematics teachers involved in the study has weak content knowledge and stick to a certain formula in teaching and therefore, lacks depth and is quite inflexible. SEI-DOST & MATHTED, (2011) described these teachers as novice teachers. They are those mathematics teachers who had just finished the required tertiary education degree and has passed the Licensure Examination for Teachers (LET) and other requirement and basically inexperienced in many aspects of teaching and handling a mathematics class.

In this regard that, as part of the schools mentoring program, the Mathematics Intervention Program (MIP) was implemented to enhance Mathematics teachers' content and pedagogical knowledge and to learn some skills in managing students, classrooms and other resources in the class.

Teaching is probably the only profession that expects its beginners to be responsible for the same work expected of experienced teachers. It is certainly difficult to get the best out of such teachers especially in term of performance of their students in public examination. By implication, therefore, the way the teacher sees and responds to their profession, especially in the classroom. His attitude could have great influence on the effectiveness of his teaching. (Achor and Duguryil, 2012).

The next table presents the results of the test which determine significant difference between competency teacher respondents in teaching Mathematics before and after their participation in Mathematics intervention Program.

As shown in the table, the results of the t-test analyses yielded that the competency of Mathematics teachers is significantly different before and after they participated in the Mathematics Intervention Program (MIP).

Table 7: *Results of the Test for significant difference between the Competency of Teachers in Teaching Mathematics before and after the Mathematics Intervention Program*

Dimension of Competence	Mean Difference (After – Before)	Computed t-value (df=33)	p-value
1. Content Knowledge			
Number Sense	2.03	25.747**	<.0001

Measurement	1.94	29.007**	<.0001
Geometry	1.96	29.022**	<.0001
Patterns, Functions and Algebra	1.95	27.655**	<.0001
Data Analysis and Probability	1.99	24.926**	<.0001
2. Teaching Skills	2.21	20.535**	<.0001
3. Material Organization and Presentation	2.36	28.325**	<.0001
4. Management of Learning Environment	2.42	27.428**	<.0001
5. Teaching Attitude	2.35	22.978**	<.0001

***Significant at p<.01 level*

Specifically, on the following dimensions: content knowledge on Number Sense; Measurement; Geometry; Patterns, Functions and Algebra; Data Analysis and Probability; Teaching Skills; Material Organization and Presentation; Management of Learning Environment; and Teaching Attitude, their probability values which are less than .01 mean that there is a significant difference in teacher's competence before and after the intervention program.

The findings implied that the teachers' participation in the Mathematics Intervention program had contributed notable impact on their competencies in teaching mathematics. Their participation in the program enhance their competencies and made their content knowledge much more solid. They are now equipped with effective pedagogies and strategies for mathematics and is able to manage the classroom learning environment satisfactorily.

Blömeke and Paine (2008) strongly supported this viewpoint by accentuating the fact that pedagogical knowledge is a knowledge typically acquired in a teacher-training program. Subject content knowledge and pedagogical knowledge make it easy for teachers to deliver mathematics lesson

SEI-DOST & MATHTED (2011) emphasized that it is the responsibility of mathematics teachers to continue learning new ideas both about mathematics and about the teaching of mathematics. They must continue to grow both as teachers and learners of mathematics. As facilitators of learning, mathematics teachers must ensure their own personal and professional growth by engaging in activities that allow them to learn new methods and ideas and produce learning support materials that will help in the teaching of mathematics.

The next table presents the results of the test which determine significant difference between teacher respondents' performance in teaching Mathematics before and after their participation in Mathematics intervention Program.

Table 8: *Results of the Test for Significant Difference between the Mathematics Teacher's Performance before and after they participated in the MIP*

Mean Performance		Mean Difference (After – Before)	Computed t-value (df=33)	p-value
Before Participation	22.15	10.91	42.279**	<.0001
After Participation	33.06			

***Significant at p<.01 level*

The results of the t-test analyses presented in the above table showed that the performance of Mathematics teachers before and after they participated in the Mathematics Intervention Program (MIP) is significantly different. The mean difference between their teaching performance of 10.91 yielded a computed t-value of 42.279. Its probability level was found at less than .01 level of significance.

It implies thereof that the participation of the teachers in the MIP is essential for attaining optimal performance in teaching Mathematics. It also indicates that teacher mentoring is effective in enhancing the competence of teachers in teaching Mathematics. The result obtained in this study was expected because the TIP used has a clear and consistent focus on mentoring, particularly, in the area of pedagogical content and knowledge of Mathematics teachers. The mentor, a Master Teacher, was trained and motivated enough to help the mentees to appreciate Mathematics.

This finding is consistent with that of Michael (2006), that participation in mentoring and support course experiences can change attitudes and beliefs, develop personal professional skills and cause changes in work relations.

The enhanced competence and performance of teacher could be attributed to the opportunity given to the mathematics teachers to interact with a teacher mentor. This is supported by the findings of Ahuja (2005) in a comparative study of Indian and American high schools that performed outstandingly in mathematics, that content knowledge with experiential and professional knowledge plays an important role in assisting teachers to adapt curriculum contents and thus influences teachers' teaching competencies and learners' performance in mathematics.

4. Conclusions

Based on the findings of the study, the researchers drawn the following conclusions:

1. The null hypothesis of the study is rejected showing that the difference on Mathematics teachers' competencies before and after their participation in Mathematics Intervention Program is significant.
2. The study also rejected the null hypothesis showing that the Mathematics teachers' performance before and after their participation in Mathematics Intervention Program is significantly different.

5. Research Limitations

This study assumes the potential impact of external validity, which refers to the validity of the cause-and-effect relationship being generalizable to other persons, settings, treatment variables, and measures. Careful selection, inclusion and exclusion criteria of participants were not considered, hence it does not claim that the results derived from the study will be true to other group of teachers, settings, and conditions.

6. Recommendations

Based on the drawn conclusions, the researchers offered the following recommendations:

1. The primary grade Mathematics teachers needs further discussion or in-service training, the researcher recommends a six-weekend in-service training program of nine hours a weekend to be conducted by the EPS and Master Teachers.
2. Continuous assessments of teachers content knowledge in Mathematics needs to be measured regularly, it might necessary to design a formative test for teachers.
3. The teacher professional development process needs to incorporate differentiation to meet the needs of teachers at varying stages of their careers and varying degrees of professional competence as determined by evaluation.
4. A more comprehensive study regarding teachers' competencies and classroom performance needs to be conducted in the light of professional development and qualification standard for Mathematics teachers.

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