

Modular Approach in Teaching Mathematics: Quadratic Function

Ariel F. Melad

Cagayan State University, College of Business, Entrepreneurship and Accountancy, Andrews Campus, Tuguegarao City
Cagayan 3500, Philippines

***Corresponding Author:**

Ariel F. Melad

Email: meladariel@yahoo.com

Abstract: The use of self-instructional program plays an important role in teaching mathematics. Self-instructional program is useful not only to the fast learner group of students but also to the remedial teaching for low achievers as well. The practice of modular approach as a remedial teaching material like the Quadratic Function significantly increased the achievement level of the students, especially the experimental group. After the remedial teaching is done, statistically there is a significant difference between the achievement level between the experimental group and the control group. This means that the experimental group achieve better performance level than the control group. There were 40 participants for this study, 20 for the control group while 20 also for the experimental group. The experimental group was given a module while the control group was taught using the traditional way using the chalk-talk method. After the completion of the remedial lessons the post-test was administered to both groups to assess the students. In addition, six Mathematics teachers were asked their perceptions regarding the module before remedial teaching will be administered. The main purpose of this study was to determine the effectiveness of module in teaching mathematics, specifically on quadratic function.

Keywords: modular approach, self-instructional program, Quadratic Function, control group, experimental group, remedial teaching, traditional method.

INTRODUCTION

Mathematics curriculum is one of the most important tools through which the mathematics teacher of today can lead the students in achieving the country's goal of development, modernization and industrialization. The goal towards increased productivity, sustainable development and global competitiveness that every Filipino should be provided the opportunity for growth and development.

Based on the researcher's observation, students who go to the secondary level of education mostly do not like mathematics and are not good in this subject. They usually obtained very low marks in mathematics. In addition to this problem, the classes usually have students with mixed abilities. It is difficult for the teacher to teach a mathematics topic to serve individual deficiencies especially the low ability students. The duration of each mathematics session is also limited, thus the teacher usually has no chance to pay attention especially to low ability students.

In the view of the above observation, the researcher believes that perhaps a better method to overcome the problem is the use a self-instructional program. This type of teaching aid could be used by students during their own free time and allowing them to proceed on their own pace, besides relieving the teacher from his tutorial functions.

The use of self-instructional program plays an important role in the teaching of mathematics, particularly lesson involving "Quadratic Function". Self-instructional program is useful not only to the fast learner group of students but also to the remedial teaching for low achievers as well. It may help the low-achievers catch up in learning the lessons with their classmates. In the Solana Fresh Water Fishery School, there are students enrolled with varied learning abilities. Some are fast learners, others are average learners and most students are poor academic background, slow readers who could hardly understand the materials that they read. The group of students is large enough for the teacher to teach in a forty- minute time. In order to help the teacher in particular as well as the school in general, solve this situation, there is a need for the implementation of a self-instructional programmed to cater to the needs of these group of students.

The self-instructional program when implemented will give a liberal mean for the students to achieve knowledge and skills in learning mathematics because the students are allowed to choose his own time in learning and

minimizing any imposition of the school authorities regarding what is to be learned and under what circumstances. Students are given opportunity to learn based on his own choices and where more moderate approach is widely

According to Cooper and Hornback [3], the self-instruction program is the created lesson for students to learn on his own and make advance with his personal ability step-by-step from easy parts to harder ones containing facts for students to answer one questions, then feedback to let him know whether his answer is right or wrong. This self-instructional program may be called “Programmed Lesson”, “Programmed Instruction”, “Auto Instruction Device”, “Teaching Machines”, or “Self-Teaching Materials”.

Programmed instruction, according to Scram [9], is the kind of learning experience in which a program takes the place of a tutor for the student, and leads him through it more probably than he will behave in a given desired way in the future. He will learn that the program is designed to teach him.

Taber [10] said that programmed instruction is a process of constructing sequences of instructional materials in a way that maximizes the fate and depth of learning, fosters understanding and the ability to transfer knowledge to new situations, facilities retention, and enhances the motivation of the student.

Callendar [2] added that the students perform the activities step-by-step at his own rate providing opportunity for them to immediately check and know if his answer is right or wrong.

Hughes [6] defines program instruction as a special kind of individualized instruction where there is a close interaction between the student and the concept being studied. It calls for a frequent responses or reaction of the student. The differences of the students in background and attitudes are greatly taken in consideration, thus making learning much more conclusive and easier.

Allen [1] agrees to the view that “the question is not whether or not modular units are desirable, but rather in what manner they may be best developed and used?” This implies that modules or self-instructional program should be developed in such a way that they enhance the facility of learning and other opportunities for innovations.

Harris [5] said that remedial teaching is a method to assist those students delayed in learning to enable them to catch up with their classmates. It is an instruction that will help them understand more to become successful in the process of learning according to the objectives set up for them. This remedial instruction can be done by person or in a small group of students of which the instructor or a teacher could pay attention to them so that it is easier for her to realize the problems and needs of the student.

Ronshausen [8] defined remedial (reading) teaching as “the teaching procession arranged to promote for better completion of teaching and learning”.

Due to rapid environment changes educators have observed a growing complexity on the nature of learners. As a result, classroom instruction has become more challenging. To be able to cater to the needs of individual students, experts in education have proposed the use of instructional materials such as modules in instruction.

Instructional materials are any device (printed or non-printed materials) used for teaching progress. This includes:

- Textbooks and teacher’s manuals
- Supplementary reading materials
- Calculators and computers
- Audio-visual aids
- Modules

The following are advantages of modular approach in teaching students:

1. it provides the opportunity of organizing awareness and sequences of experiences to reflect special interest of the teacher on the students;
2. allows the teacher to focus on the deficiencies of students on the subject matter;
3. assesses the program of students in learning
4. serves to eliminate to the necessity of covering subject matter presented to the students; and
5. reduce routine aspects of instructions and gives the teacher a chance to enjoy her personal contact with the students

Renato Gacayan [4] conducted a study on the proposed instructional materials in Trigonometry for SLCT Science High School. The following are his findings on the common problems encountered by students:

1. Students usually get low grades in Mathematics; they are poor in reading comprehension.
2. Weak in problem-solving and four fundamental operations, perplexed with symbols, formulas and principles in mathematics.
3. Poor background in the elementary and secondary levels.
4. Lack of time for studying because of home chores and they easily forget past lessons in Mathematics.

Based on his findings, he came up to the development of instructional materials to cope these problems in the teaching of Mathematics.

Lopez [7] in his study, attempted to find out the effectiveness of programmed materials and programmed instruction. From his study, he deduced the following conclusions

- a. That the new instructional approach was effective in the teaching of definite integrals and applications to area problems by which the effectiveness of the module was reflected in the achievement and attitudes of the student.
- b. That the students' attitudes were generally favorable towards programmed instruction and the design of the programmed materials was made such that the individuals need as well as differences in learning pace was met.

The researcher intended to find out its effectiveness before making further decisions whether or not to adapt it and subsequently to produce more self-instructional materials of similar nature for other mathematical topics.

STATEMENT OF THE PROBLEM

The main purpose of this study was to determine the effectiveness of module on Quadratic Function in Advanced Algebra.

Specifically, the study was designed to seek answers to the following questions:

1. What are the perceptions of the mathematics teachers on the module as a printed material for remedial teaching in terms of:
 - a. Language
 - b. Graphs and table
 - c. Instructions/Directions
 - d. Activities
 - e. Contents/Concepts
2. What is the pre-test score of the students in the control group and experimental group?
3. Is there a significant difference between the pre-test score of the control group and experimental group?
4. What is the post-test score of the students in the control group and experimental group?
5. Is there a significant difference between the post-test score of the control group and experimental group?
6. What is the gain score of the control group and experimental group?

RESEARCH METHODOLOGY

Participants of the Study

Table 1 shows the profile of student respondents in this study. There were 40 respondents, 20 for the control group while 20 also for the control group. Out of the 40 respondents, 14 students gained an average of 75 – 76 for the first grading period. While the remaining 26 students gained an average of 77 – 78.

Table 2 presents the profile of the teacher respondents in the study. Out of the six (6) respondents, there are 2 males and 4 females. Three is under 10 years and above teaching experience, 2 have 5 – 9 years teaching experience, while 1 or is under the 1 – 4 years teaching experience.

Table 1: Profile of Student Respondents

Control Group	Average Grade	Experimental Group	Average Grade
Student 1	76.80	Student 1	77.80
Student 2	77.08	Student 2	76.12
Student 3	76.79	Student 3	76.79
Student 4	78.04	Student 4	77.93
Student 5	78.31	Student 5	77.98
Student 6	77.79	Student 6	78.10
Student 7	77.76	Student 7	78.05
Student 8	77.05	Student 8	77.64
Student 9	76.15	Student 9	76.12
Student 10	75.50	Student 10	77.15
Student 11	75.89	Student 11	75.89
Student 12	78.01	Student 12	78.04
Student 13	78.21	Student 13	75.75
Student 14	78.11	Student 14	76.75
Student 15	78.00	Student 15	77.10
Student 16	77.00	Student 16	77.18
Student 17	76.12	Student 17	77.12
Student 18	76.89	Student 18	77.23
Student 19	77.98	Student 19	78.00
Student 20	76.05	Student 20	76.45

Table 2: Profile of Teacher Respondents

Teaching Experience	Male	Female	Total
10 years and above	1	2	3
5 – 9	1	1	2
1 – 4	0	1	1
Total	2	4	6

The study made use of quasi- experimental design the pre-test – post-test Control Group Design. This design calls for the formation of an experimental and a control group. The subject was randomly assigned to the two groups. The pre-test was administered to the two groups before starting with remedial teaching. The experimental group was exposed to the module while the control group was taught via the traditional method (or chalk and talk method). After the completion of the remedial lessons the post-test was administered to both groups.

The procedures which are employed for the experimental group and the control group are respectively described as follows:

The Experimental Group:

The experimental group was given a module, “Quadratic Function”. The researcher explained to the group the use of the module. They were allowed to study the material within 5 days at home, after which the post-test was administered.

The Control Group:

The control group was taught by the researcher in the traditional way using the chalk-talk method. The content of the lesson is the same as that of the module (Quadratic Function). The lessons were taken for five days (40 minutes per day), after which the post-test was administered to them.

The Instrument

The researcher made use of questionnaires to gather data on perceptions of the Mathematics Teachers regarding the prepared module after which the module was revised based in the suggestions of the teachers. The achievement test was used as the pre-test and post-test.

Data Gathering Procedure

The following steps were undertaken by the researcher:

1. The researcher asked permission from the School Principal for the utilization of the Mathematics teachers as well as 40 fourth year students as samples.
2. The questionnaires were floated to the Mathematics teachers to determine their perceptions regarding the module.

The pre-test and post-test were administered before and after the remedial teaching was conducted.

Statistical Analysis

After the data were collected, the following analyses were undertaken in response to the objectives of the study. To determine the perceptions of the Mathematics teachers regarding the module, the weighted mean and percentage were used. A four- point likert scale was used to determine the perceptions of the teacher on the module. To answer the hypotheses, the t-test for uncorrelated means was used.

RESULTS AND DISCUSSION

Perception on Mathematics Teachers on the Module in terms of Language, Graphs and Tables, Instructions, Activities, and Contents.

Table 3: Perceptions of Mathematics Teachers on the Module.

Module	Weighted Mean	Descriptive Value
Language	3.67	Strongly Agree
Graphs and Tables	3.67	Strongly Agree
Instructions	3.50	Strongly Agree
Activities	3.70	Strongly Agree
Concepts	3.96	Strongly Agree

Table 3 shows the perceptions of the mathematics teachers on the module in terms of Language, Graphs and Tables, and Instructions/Directions. In terms of the Simplicity of the Language, out of the six mathematics teachers, two said that some of the words used were difficult, while four of them thought that the words were in general, simple and easy to understand. The weighted mean is 3.67 which falls under the descriptive value of *strongly agree*, based on the set range. Hence, the respondent strongly agrees on the statement that the words used were simple and easy to understand.

In terms of graphs and tables, four of them perceived that all the graphs and tables were very useful, while two said that most of the graphs and tables were useful. The weighted average is 3.67 which falls under the descriptive value of *strongly agree*. This means that the graphs and tables were very useful.

In terms of instructions, out of 6 mathematics teachers, three of them said that all instructions were clear and three also perceived that instructions are clear. The weighted mean is 3.50 which falls under descriptive value of *strongly agree*. Hence, the instructions were clear.

Also, in terms of activities, out of 6 respondents, only one who gave a rating of three from each of the description Relevant and Useful, while five of them rated 4. For the description Interesting and Easy, two rated each as 3 while four rated 4. For the description of the activities as orderly, three rated it as 3 and three rated 4. There were no respondents who rated each as 1,2 or 3. The weighted mean is 3.70 which falls under a descriptive value of *strongly agree*. This shows that the activities are relevant and interesting.

In terms of contents, on statement 1, ordering of concepts taught in the module is form easy to difficult. Out of six respondents *strongly agreed*, while only one just agreed. Statement 2, 3, 4, 5, and 6, out of six respondents, six strongly agreed based on the set range. Hence, the respondents agree that:

- The concepts were appropriate for students learning style and pace;
- The concepts were taught in logical sequence;
- The concepts were taught are reinforced with meaningful examples and applications and
- The contents were relevant to the level of the students.

The weighted mean is 3.96 which falls under a descriptive value of *strongly agree* to the contents of the module. Only one suggestion made by the respondents and that is “include more exercises in the module”. Therefore, the module is almost acceptable to the mathematics teachers.

Table 4: Comparison of the Pre-Test Results of the Experimental and Control Group

Respondents	Mean Score	Computed t	Tabular t	Significance	Decision
Control Group	14.45	0.5927	2.04	Not significant at 0.05 level of significance	Accept Ho1
Experimental Group	13.90				

Table 4 presents the pre-test result of the experimental group and the control group. The mean score of the control group is 14.45 while the mean score of the experimental group is 13.90. The computed t is 0.5927 and the tabular t-value is 2.04 at 0.05 level of significance. The null hypothesis 1 is, therefore, accepted, since the tabular t is greater than the computed t, hence, there is no significant difference between the pre-test scores of the control group and the experimental group. This shows that the two groups were the same level of achievement before remedial teaching was conducted.

Table 5: Comparison of the Post-test Results of the Experimental and Control Group

Respondents	Mean Score	Computed t	Tabular t	Significance	Decision
Control Group	31.55	4.5657	2.04	significant at 0.05 level of significance	Reject Ho2
Experimental Group	38.1				

Table 5 shows the comparison of the post-test scores of the experimental group and the control group. The mean score of the control group is 31.55 while the mean score of the experimental group is 38.1. The computed t is 4.5657 while the tabular t-value at 0.05 level of significance is 2.04. Since the computed t-value is greater than that of the tabular t-value, null hypothesis 2 is rejected, hence there is a significant difference between the post test scores of the experimental group and the control group, and since the mean score of the experimental group is higher than that of the control group, it can be concluded that the experimental group achieved better than the control group.

Table 6: Comparison of the Gain Score of the Experimental Group and the Control Group

Respondents	Mean Score	Computed t	Tabular t	Significance	Decision
Control Group	16.5	6.2994	2.04	significant at 0.05 level of significance	Reject ho3
Experimental Group	24.7				

Table 6 shows the comparison of the gain scores of the experimental group and the control group. The mean gain score of the control group is 16.5 and the mean score of experimental group is 24.7. The computed t-value of 6.2994 which is greater than the tabular t-value of 2.04 at 0.05 level of significance, hence null hypothesis 3 is rejected. Thus, there is a significant difference between the mean gain scores of the experimental group and the control group. And since the mean gain score of the experimental group was higher than the mean gain score of the control group it can be concluded that the experimental group has better achievement than the control group.

CONCLUSION

Based on the findings of the study, the following conclusions were derived:

1. The use of module as a remedial teaching material significantly increased the achievement level of the experimental group.
2. The use of module on “Quadratic Function” is effective in increasing the achievement level of the students.
3. Most of the Mathematics Teachers of Solana Fresh Water Fishery School perceived that the module “Quadratic Function” is a very good printed material for remedial teaching.
4. The module on the “Quadratic Function” is a very good material for remedial teaching to low-achievers and there were only one common suggestions made by the teacher-respondents, that is “add more exercises in each of the activities of the program”.
5. The fourth year low-achievers of Solana Fresh Water Fishery School, school year 2009 – 2010 were more or less of the same achievement level before the remedial teaching was conducted using two different teaching approaches, module for the Experimental group; and Chalk and Talk approach for the control group.
6. After the remedial teaching, it was found out that the experimental group performs better in their academic performance compared to the control group.
7. Most of the Mathematics teachers of Solana Fresh Water Fishery School have at least five years teaching experience.

RECOMMENDATIONS

On the basis of the findings and conclusions of this study, the following recommendations are given:

1. Mathematics Teachers are encouraged to:
 - Use a module for remedial teaching.
 - Validate existing module in mathematics
 - Develop and validate simple module on different mathematics concepts for low-achievers.
2. Mathematics Supervisors and Masters Teachers should continuously conduct seminar-workshop on the construction of the module.
3. Mathematics teachers are encouraged to adopt the Quadratic Function for remedial instructional material for low learners through a Division/Regional memorandum.
4. Similar study should be conducted to further improve the module on Quadratic Function.

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