IOSR Journal of Mathematics (IOSR-JM)
e-ISSN: 2278-5728, p-ISSN: 2319-765X. Volume 12, Issue 5 Ver. VII (Sep. - Oct.2016), PP 59-65
www.iosrjournals.org

Effectiveness of Modular Instruction in Word Problem Solving of BEED Students

Edgar Julius A. Lim
Eastern Samar State University, Philippines

Abstract: *This study used a Quasi-experimental Design to determine the effects of modular instruction to third year BEED students of Eastern Samar State University (ESSU) who were exposed to lecture method and modular instruction in teaching word problem solving. Its purpose was to seek answers to the following questions: (1) Is there a significant difference in the pretest mean score? (2) Is there a significant difference in the posttest mean scores? (3)Is there a significant difference between the mean gainscores?Based on the pretest and posttest mean scores of both control and experimental groups, the following findings were formulated; (1) there is no significant difference between the pretest mean scores of the subjects; (2) there is a significant difference between the post-test mean scores of subjects; and (3) there is a significant difference between the mean gain scores of the two groups of respondents – experimental and control groups. The experimental group who were taught by modular instruction performed significantly better than the control group who were taught using the traditional lecture method. Based on the findings cited, it is concluded that modular instruction in teaching Math specifically word problem solving, is an effective teaching approach. Though the results of this study showed that learning took place in both groups using the two methods of teaching, the subjects who were taught by modular instruction performed significantly better than the subjects exposed to traditional lecture method.*

Keywords: *effectiveness, modular; module; experimental; word problem solving;*

I. Introduction

If one has to look closely at the contemporary problem of how to raise the quality of education, no matter what the discipline is, it would be obvious that the answer lies in the right educational objectives at one end, effective evaluation at the other, with instructional procedures and materials in between. Evaluation of student learning to check on whether the educational objectives have been achieved cannot be done thoroughly if the instructional materials are not first subjected to evaluation (Robles, 1993).

The nature of the learning process has been studied by different psychologists (Gregorio, 1976). Many experiments were performed and the literature on the subject is voluminous. There has been a continual progress in exploring what is not known about learning. Each year sees new discoveries and hypotheses. Some proposed hypotheses were proven wrong and some older discoveries were made eligible for major modification.

Based on a great number of studies on how children learn, educators came to define teaching as "an aggregate of organized strategic methodologies aimed to produce a desired learning outcome" (Salandanan, 2005). It consists of well-planned tasks which connect the teacher's entire act to learning. Learning is the definitive goal and teaching then is a personal venture.

The act of teaching is so complex that it cannot be said that a specific way of teaching is superior to other ways for all purposes, with all teachers, with all students for all times and circumstances. Certain procedures, teaching styles and techniques that are generally not recommended seem to work well for a specific teacher. There is no fast rule in the choice of the best strategy to be used in teaching. The teacher should adapt different strategies of teaching to suit the needs of the students (Abad, 2006).

The skill in selecting the right strategies in the context of a particular lesson is critical (Salandanan, 2005). The teacher should be knowledgeable and observant enough on how the students learn to be able to apply the appropriate teaching techniques and strategies.

Gregorio (1976) claimed that successful classroom instruction depends upon the technique of teaching; through it, the learning activity of the pupils is guided. Pupil activity, without the organization of effort and material to achieve a definite goal, would be a waste of time and effort and would not achieve satisfactory results in content learned or study habits. It is the teaching technique that provides this guidance for the pupils.

In the present times, many Filipinos find mathematics difficult to understand. Different instructional techniques and strategies have been deployed to enhance the teaching – learning process in a mathematics class. One of the best methods in making the students understand mathematical concepts is the problem solving. Learning mathematics using this method in particular enhances the critical thinking skills of the learners. However, this is so much affected by the ability of the teacher to systematically present the concepts for easier understanding. This method can be done in different ways, such as conducting lecture or using prepared

modules. Using the usual lecture method in solving problems in mathematics is the most commonly used. For this reason, the researcher would like to determine the effects of using prepared modules for problem solving in mathematics in the academic performance of BEED third year college students of Eastern Samar State University.

Theoretical Background

This study is anchored on the theories on individualizing instruction through modules. According to Kemp and Smelie (1989), individualizing instruction plays a big role in modular instruction. Its main attributes include the individual assuming responsibility for their own learning, proceeding with activities and materials at their own level and studying at their own pace. This principle is in consonance with Thorndike's law of readiness and law of effect where the law of readiness states that when a person is prepared to respond or act, giving the response is satisfying and being prevented of doing so is annoying.

Statement of the Problem

This study was designed to determine the effectiveness of modular approach to the academic performance of two third year BEED classes of Eastern Samar State University (ESSU) who were exposed to the usual lecture method and using modules in teaching word problem solving.

Specifically it sought to answer the following questions:

1. Is there a significant difference in the pretest mean scores between the control group and the experimental group?
2. Is there a significant difference in the posttest mean scores between the control group and the experimental group?
3. Is there a significant difference between the mean gain scores between the control group and the experimental group?

Review of Related Literature and Studies

The objective of democratic education is the optimum development of the individual. To meet this end, it is imperative that greater attention should be given to the needs of individual learners – thus the demand for individual instruction. Individual instruction is backed by the philosophy that every child is unique. People develop at different rates. Development is relatively orderly and development takes place gradually. (Woolfolk, 1990) One technique to individualize instruction is to use modularized instruction, where individual differences of students in their capacities to learn are taken into account. Individualized instruction develops critical thinking. Students are encouraged to question, criticize and argue their point of view. It also develops one's self-concept by recognizing the desirability of individual differences. The basis for this approach is the fact that every student is unique with his own potentials, abilities, interests, and needs. Thus, no two students can learn the same concepts at the same rate in the same manner.

The Philippine Education Quarterly (1985, as cited by Figuerres, 1994) reported that modules can take the place of a teacher. These self-learning devices help pupils to learn or acquire skills, knowledge and information in the absence of a teacher. These materials provide sufficient reinforcement, enrichment and source materials. They allow also the learner to work at a rate style and level situated to his capacity.

Among the forms of individualized instruction, modules are effective and economical in developing specific knowledge and skills. Modules induce learning with minimum teacher direction and supervision. Furthermore, these develop learning and grading strategies, improve classroom management techniques, and encourage achievement for greater use of existing educational resources through the establishment of realistic obtainable learning goals within an individualized program of studies (Rillo, 1995).

A module is a self-contained, independent unit of instruction prepared for the purpose of attaining specific instructional objectives. It is characteristically self-directing since it includes instructions on how the various investigation will be pursued also included is a listing of the materials and other resources that should accompany the text of the module. Classroom instruction using modules is described as self-pacing where the pupil progress through the learning tasks at his own rate (Salandanan, 2001).

Lockwood (1998) differentiated the characteristic of textbook and modules and pointed out the advantages of the latter, to wit: modules arouse interest, written for learner use; give estimate of study time; are designed for a particular audience; always gives aims and objectives, may have many ways through it; are structured according to the needs of the learners; primarily emphasize self-assessment; can be alert to potential difficulties; always offer summaries; are personal in style; are content unpacked; have more open layout; always conduct learners' evaluation; provide study skills advice; require active response; and aimed at successful teaching.

According to Salandanan (2009), self-instructional materials are those which are described to be self-contained and the manner of presentation is such that the learning activities can be undertaken individually or in

small groups. These materials are most effectively used in individualized instruction programs. The self-instructional module helps in providing remedial instruction for slow learners and enrichment materials for fast learners. Topics can best be presented through these self-instructional materials. With the use of one, the student is allowed ample time and assistance to finish the prescribed learning activity at his own pace. The lesson will surely be enjoyed and the experience gained will be satisfying.

The best features of self-instructional materials are described by Race (1989). He explained that self-instructional materials may come in the form of modules, self-learning kits, and the like, and are interaction-centered rather than content-centered. These are written to entice the learner or get the learner interested and involved. Self-instructional materials develop the self-esteem of learners and give them a confidence boost. This is possible because the learners are given the framework within which to think things out for themselves. More importantly, the learners are given the credit for the newly acquired knowledge. Most self-instructional materials are purpose-built and are structured to meet the learners' needs. Race further emphasized that the main principle underlying the use of self-instructional materials is to make learning reactive, interesting, successful and humane.

Informal and brief lectures as well as explanations are well-suited to large groups wherein few materials and equipments are needed. These can also be used in regular classrooms, small groups and large settings. However, lecturing is often described as "unnecessary", "dull" and a "waste of time". It was pointed out that lectures increase the students' passivity and reduce the students' role to note-taking instead of more active learning. Another critic noted that if a student misses a point or is lost during lecturing, he or she cannot interrupt for a personal explanation or stop and review, as with a book, computer program, or tape (Castillon – Boiser, 2000).

As used in higher education, lecture strategy is a teaching procedure which involves classification, exposition, and description of some major ideas that have been cast into the forms of questions. The fundamental aim of lecture, is to develop the act of listening and to develop creative thinking and reasoning. It is therefore recommended that, for the lecturer to be effective and productive, it must be interesting, well-expressed, concise, well-organized, and adapted to the abilities and experiences of listeners (Zulueta and Guimbatan, 2003).

To further enrich this study, the researcher engaged in a search for studies related to this investigation. Alberto (as cited by Hena, 1997) developed self-instructional modules based on the needs and interest of fourth year BSE/BSEEd students, the effectiveness of which she tested is an experimental research. The result showed that the modules were effective tools in bringing about learning as indicated by the high achievement scores of the experimental group.

The proposed work text of Navarro (1999) was found out to be suited for second year Engineering students proved that the students are capable of performing better in Mathematics through the use of Modules. The study of Hena (1997) on the development of modules in Basic Mathematics as tried out among Teacher Education students proved that students are capable of performing better in Math through the use of modules.

Salvacion (2000) experimental group exposed to the instructional material in teaching Fundamentals of Math performed better than the controlled group. The modules were acceptable as textbook in the subject.

An investigation of Mian (1982) in her "Experimental Study of Teaching Science through Modules" found out that her students welcomed the use of modules on account of the following advantages: (1) The class does not hold fast students back and they are not bored by extra drill they do not need since they may go on with the next topic in accordance with the decision of the teacher. (2) The student can proceed at his own pace knowing that he has an excellent opportunity of getting grades comparable to that of the fast students and he gets more individual attention in times of difficulty. (3) All students get steady feedback on their progress and more individual attention when needed.

Receno (2001) developed and evaluated instructional materials for the enhancement of listening skills among freshman students of St. Michael College of Laguna. Among others, she concluded that freshman students need instructional materials that will help them realize and make use of their internal language resources to be able to attend to and appreciate listening.

Aquino-Danganan (2001) proposed instructional modules in developing computational skills in College Algebra. She mentioned that the proposed instructional modules had titles, instruction to the learners, rationale, objectives, pretest with answer keys, worksheet assignment, progress check with answer key and post-test with answer key. The format and language of each were properly organized, clear and simple. The objectives of each module were specific and were based on the course syllabus. The topics were properly developed and explained and the activities and exercises facilitated student learning in College Algebra.

Aggabao (2002) made a study aimed at developing individualized self-instructional modules on selected topics in Basic mathematics for instructional use at the Teachers College in Isabela State University. After making use of the experimental method, concluded that instructional materials used at the college for Basic Mathematics are inadequate and are not designed for self-instruction; that instruction through self-

instructional materials is as effective as the prevailing teaching method of instruction; and students as well as teachers generally have a positive attitude toward the use of individualized, self-instructional materials as a mode of instruction in Basic Mathematics.

The study of Madriaga (2004), "Effects of Modular Instruction in Teaching Physics" revealed that the use of modules give the teacher more time to deal with the students on one-on-one basis. She found out that the performance was better on the experimental group exposed to modular instruction.

Lacdao (2004) in his thesis "A Comparative Study of the Effects of Modular Instruction and Lecture Discussion Method on the Achievement of Grade VI Pupils in Mathematics" mentioned that the experimental group in his study who were taught using the instructional modules, performed better than the control group who were taught using the traditional method of teaching.

The study of Cavero – Delgado (2006), "Effects of the Use of Computers, Integrated to an Instructional Module on Functions of the Attitudes towards Mathematics and the Achievement in Functions in Precalculus of College Students" proves that the averages of the students in the end of the study increased significantly in the experimental group. The traditional treatment of the education of precalculus to university students compared with that one where the technology is used, as an instructional module on functions integrated in the computer, showed in the statistical analysis, significant results that allow us to conclude that this one is an effective tool.

Cappetta (2007) in his dissertation, "Reflective Abstraction and the Concept of Limit: A Quasi-Experimental Study to Improve Student Performance in College Calculus by Promoting Reflective Abstraction through Individual, Peer, Instructor and Curriculum Initiates", the pretest-posttest scores showed that the students in the experimental group scored significantly higher than the students in the traditional section on a posttest of limits.

The study of Rizaldo, et. al., (2007) "Comparative Effects of Modular and Traditional Methods in Teaching Analytic Geometry", concluded that students performed better and mastered the subject matter using the modular method of teaching.

II. Methodology

Research Design

This study utilized the Quasi-experimental Design because the subjects were not grouped by randomization. The illustration of this design is shown below;

$$\begin{array}{ccc} O_1 & X & O_2 \\ \hline O_1 & & O_2 \end{array}$$

The "X" represents the treatment of the study, which are the modules. The "O_1" represents the pretest and the "O_2" represents the posttest of both experimental and control groups. The broken line between the two groups suggests that there had been no randomization done to the respondents.

This design involved the use of two groups namely; the experimental and control groups. The experimental group was taught using the instructional modules while the control group was taught using the traditional method.

The Research Subjects

The subjects of this study were two heterogeneous sections of third year college students who are taking up Bachelor of Elementary. One section was classified as controlled group who was taught using lecture – discussion method while the other section, the experimental group was taught using instructional modules. Both groups were taught with exactly the same subject matters.

Research Instruments

This study utilized the following instruments: (1) Modules in Problem Solving; (2) Teacher-made test, test which was used to measure the subjects' pretest and posttest achievement on the two modes of instruction.

Validation of Instruments

To ensure the content validity of the test, a list of objectives for each lesson was prepared, a table of specification was constructed and the researcher prepared a thirty-five – item objective type of test.

The initial draft of the test was submitted for correction to fellow math teacher in the university. The test was given to students who already took the course and result was used for item analysis. The final revision was based on the result of item analysis.

The modules were prepared by the researcher and were subjected to face and content validity by fellow math teachers in the university.

Research Procedures

The teacher who handled the classes under experimentation discussed on how the process starting from the pretest down to the posttest should be done. Two sets of tests were administered to both groups; control and experimental groups. The pretest was given before the experimentation began, and the posttest was administered after the instruction was conducted.

The study was conducted from January to March of school year 2011 – 2012.

After gathering the data, data were treated statistically, analyzed and interpreted.

Treatment of Data

The T – test for dependent samples was used to test whether the pretest and posttest mean scores significantly differ between the two different groups – control and experimental groups. It

III. Results

This part presents the data gathered from the experimental and control groups using the achievement test. The results are presented according to the statement of the specific questions that directed the study.

Table 1 : T-test of the Difference in the Pretest Mean Scores between the Control and the Experimental Groups

Groups	N	Mean	SD	Mean Difference	t-test	p	Interpretation
Control	40	4.55	1.616	0.915	-2.805	0.056	not significant
Experimental	43	5.17	1.351				

Table 1 presents the pretest mean scores of the both control and experimental groups with a mean difference of 0.915 with a p value of 0.056 which is greater than the 0.05 level of significance, this means that the difference is insignificant whichimplies that the two groups of respondents have relatively the same status at the beginning of the study.

Results of this study show that when new concepts are encountered by the learners their interpretation is based on their past learning. Low result of the pretest is but normal for the respondents because they have little knowledge about the new lesson.

A person's response to a new situation is determined by innate tendencies to respond and by elements in similar situations to which he has acquired responses in the past, “Law ofResponse Analogy”.

Table 2: T-test of the Difference in the Posttest Mean Scores between the Control and the Experimental Groups

Groups	N	Mean	SD	Mean Difference	t-test	p	Interpretation
Control	40	16.88	2.919	2.823	-5.154	0.000	significant
Experimental	43	19.70	2.018				

Table 2 illustrates the posttest mean scores of the 40 and 43 subjects from the control and experimental groups having a mean difference of 2.823 and a p value of 0.000 which is less than the 0.05 level of significance which reveals a significant result.

The computed t value clearly designates that individualization of learning would make an improvement in relation to the learners’ performance. The posttest result of the subject of the study show that there is a significant difference in the performance of the subjects emphasizing that the use of module in teaching this concept in math is a better teaching method.

“Learning occurs automatically”, one of Thorndike’s theory of learning, shows that when the subjects under study was exposed to the two teaching approaches, as long as they were ready to respond, they learned automatically.

Table 3: T-test of the Mean Gain Scores between the Control and Experimental Groups

Groups	Pretest	Posttest	Mean Difference	Mean Gain	t-test	p	Interpretation
Control	4.55	16.88	12.33	2.20	-3.027	0.003	significant
Experimental	5.17	19.70	14.53				

Table 3 shows the mean gain scores of both the control and experimental groups which obtained a mean gain of 2.20 setting a significant p value of 0.003.From the results above, it is implied that the use of learning modules as a tool in individualization of learning is an effective method of teaching and would help improve the performance of learners because the subjects only study when they are ready, they were never “forced” to learn, learning took place because they were ready.

This is supported by Thorndike's Law of Readiness which states that a learner's satisfaction determined by the extent of his preparatory set, that is, his readiness for action. Findings proved that subjects of the study were ready to learn and that they responded positively, especially with the experimental group.

IV. Conclusions And Recommendations

Based on the pretest and posttest mean scores of both control and experimental groups, the following findings were formulated;

1. There is no significant difference between the pretest mean scores of the subjects exposed to the lecture method and the pretest mean scores of those who used the instructional modules.
2. There is a significant difference between the post-test mean scores of subjects who were exposed to the traditional lecture method and the posttest mean scores of the subjects who were taught using the instructional modules.
3. There is a significant difference between the mean gain scores of the two groups of respondents – experimental and control groups. The experimental group who were taught using the modules performed significantly better than the control group who were taught using the traditional lecture method.

From the findings above, it is concluded that the use of Modules in teaching Math specifically word problem solving, is an effective teaching approach. Effective in the sense that it helped the subjects of the study learn concepts in mathematics without cramming in keeping up with the pacing of the teacher. The use of modules in teaching these particular concepts in Math was very useful for the respondents in developing their individual learning study habits. Though the results of this study showed that learning took place in both groups using the two methods of teaching, the subjects who were taught using the modular approached performed significantly better than the subjects exposed to traditional lecture method and it is concluded that modular approach is an applicable and effective teaching approach that could be used in teaching mathematics subjects.

Recommendations

Based on the findings and conclusions of the study, the following recommendations are presented:

1. Mathematics teachers determine their students' attitude towards mathematics before starting the course to enable the former to select and employ the appropriate teaching strategy.
2. Teachers utilize modular instruction as an alternative strategy in teaching other tertiary mathematics courses in the other campuses of Eastern Samar State University.
3. School administrators require professors to use the developed module in other campuses of the Eastern Samar State University system to further confirm its effectiveness.
4. School administrators provide a seminar on module construction for the faculty of Eastern Samar State University system to improve mathematics instruction.
5. Teachers develop more modularized materials on different topics in mathematics for variation of teaching strategies.
6. Future researchers conduct a true experimental study on this study to determine the effect of modular instruction on the academic performance of students in other learning areas in mathematics to confirm the effectiveness of the use of modular instruction.

References

[1]. Abad, Ma. Leah I. (2006) "Training Needs & Performance of Engineering Math Teacher in the State Colleges of Region VIII: Inputs to a Proposed In-service Training Program," Unpublished MAIS Math Thesis, Leyte Institute of Technology, Tacloban City, Philippines.
[2]. Aggabao, Ambrose Hans. Development and Evaluation of Individualized Self-Instructional Modules on Selected Topics in Basic Mathematics. (Journal of Research, Isabela State University, Vol. XI, No. 1, January – December 2002).
[3]. Aquino-Danganan, Aussie. (2001) "Development and Validation of A Module in Developing Computational Skills in College Algebra" Unpublished Thesis, Tarlac State University.
[4]. Cappetta, Robert W., 2007, Reflective Abstraction and the Concept of Limit: A Quasi-Experimental Study to Improve Student Performance in College Calculus by Promoting Reflective Abstraction through Individual, Peer, Instructor and Curriculum Initiates, (Dissertation Abstract International Vol. 69 No. 2 August (541-A)).
[5]. Castillion-Boiser, Diosdada, (2000) Strategies for Teaching: A Modular Approach, Quezon City: Rex Bookstore Inc.
[6]. Cavero-Delgado, Ana J., 2006, Effects of the Use of Computers, Integrated to an Instructional Module on Functions of the Attitudes towards Mathematics and the Achievement in Functions in Precalculus of College Students, (Dissertation Abstract International Vol. 67 No. 6 December (2084-A)).
[7]. Figuerres, O. (1994) "Development and validation of learning packages in automotive technology III". Unpublished doctoral dissertation, De la Salle University.
[8]. Gregorio, Herman C. (1976) Principles and Methods of Teaching, Quezon City: Garotech Publishing
[9]. Hena, LJ (1997) "Developing Models for Teacher Education students in Basic Math 1". Unpublished Doctoral Dissertation, University of Eastern Philippines, Catarman, Northern Samar.
[10]. Kemp and Smelie, (1989) Planning, Producing and Using Instructional Media, New York: Harper & Row,

[11]. Lacdao, Melchor O. (2004) "A Comparative Study of the Effects of Modular Instruction and Lecture Discussion Method on the Achievement of Grade Six Pupils in Mathematics" Unpublished Master's Thesis, Eastern Samar State College, Borongan, Eastern Samar.
[12]. Madriaga, Estelita A. (2004) "Effects of Modular Instruction in Teaching Physics", Unpublished Master's Thesis, Samar State Polytechnic College, Catbalogan Samar
[13]. Mian, Ma. Shabjshahjajan "Experimental Study of Teaching Science through Modules," (Asian Center of Education Innovation for Development (ACEID), No. 6 December 1982).
[14]. Navarro, M., (1999) "Development & Validation of a Proposed Work Text in Advanced Engineering Mathematics" Unpublished Doctoral Dissertation, Centro Escolar University, Mendiola Manila.
[15]. Race, Phil. (1989) The Open Learning Handbook. USA: Nichols Publishing
[16]. Receno, Carmela N. (2001) "Development of Instructional Materials for the Enhancement of the Listening Skills among Freshman College Students of SMCL" Unpublished Thesis Philippine Normal University
[17]. Rilio, J.B. (1995) "Effectiveness of individualized modular approach to instruction in secondary economics" Unpublished Master's Thesis, UP, Diliman, Q.C.
[18]. Rizaldo, Rosita, et. al., (2007) Comparative Effects of Modular and Traditional Methods in Teaching Analytic Geometry (A Publication of Research & Educational Development Training Institute, Vol 6).
[19]. Salandan, Gloria. (2001) Teacher Education Journal. Quezon City: Katha Publishing Co., Inc.
[20]. Salandanan, Gloria G. (2005) Teaching and the Teacher, Quezon City: Adriana Printing Co., Inc.
[21]. Salandanan Gloria G. (2009) Teacher Education (QC, KATHA Publishing Co., Inc.
[22]. Salvacion, M, (2000) "A Proposed Instructional Material in Fundamentals of Math for Freshmen College Students" Unpublished Doctoral Dissertation, Centro Escolar University, Mendiola, Manila.
[23]. Woolfolk, A. E., (1990) Educational Psychology. Massachusetts: Allyn & Bacon
[24]. Zulueta, Francisco, et. al., (2003) Teaching Strategies & Educational Alternatives. Vol. 1, Mandaluyong City, Philippines: Academic Publishing Corporation, 2003