

Effect of Modular Approach Teaching on Achievement of Secondary School Mathematics Students

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Abstract

Advancement in teaching techniques has become an essential issue in education. The study ascertains the effects of the modular approach teaching in mathematics for secondary school students. Modules are developed and used by teachers teaching plans by reflecting the skills, abilities and related information in respective unit speaking Current study targeted the module development for teaching of mathematics at grade 10th and to give a comparison between the academic achievement of control & experimental groups treated through traditional & modular approach. The research was conducted by designing an experiment and was based on modules. The targeted population was the grade 10th students. Pre & post-tests were conducted after treatment and a significant difference was found in scores of the two groups. Scores of the experimental group were found higher than the control group. The originality value of the study explores the essential vital role that modules can play in mathematics teaching and how we can use modules to enhance the creative challenges that lead to an improvement in mathematics comprehension and make it valid for every stage of learning.

Keywords: Lesson plans, modular approach, students' participation, school curriculum, teachers' role

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Introduction

Mathematics is a very difficult subject rather than other subjects, both to learn and to teach. A mathematics teacher must have command of his methods and approaches in teaching. The teacher is expected to possess a keen knowledge of the criteria of effective teaching and the subject matter to be taught, a wide range of knowledge of various methods and techniques of teaching different kinds of students with the aid of the appropriate visual aids and techniques (Aquino, 2008).

Modular instruction is one of those teaching approaches where the students have to set themselves active in the learning process. The students utilize their own abilities at their own pace. It differs from the traditional one where conceptual learning of students is kept forth by the teacher instead of just focusing on lecture delivery by the teacher. Students usually face difficulties in the traditional classroom environment. Whereas, the modular approach may be a good alternate to traditional teaching. The student has the responsibility of learning about his attitude and behavior. Learners get a chance to participate in improved interaction among their classmates. The teacher's set of instructions kept in the module provide functional student-teacher interaction. The major aims of teaching mathematics are to develop the knowledge and related skills among learners (Grouws, 1999).

This technique involves the educational resources displayed to capture the targeted understanding. The groups of students who use modular cooperative learning, modular self-instruction and traditional method significantly differ in the level of understanding of mathematical concepts. The following perspectives are related to the development of ideas concept formation, comprehension, achievement in mathematics, mathematical logical ability, a habit of practice, motivation, reinforcement and further showing their better performance (Padmapriya, 2015).

The lives of every learner are modified by educators through positive interaction between them (Ajaib & Yousaf, 2018). An educator with no difficulty can turn into an informative head; can generate constructive change in the classroom by matching teaching strategies with students' characteristics and so can shape the surroundings, or even the fortune of the nation. Then again, an educationalist can similarly destroy the lives of citizens. There is always a need to prepare learners for life (Yousuf & Imran, 2018). Experts' instruction put huge stress on the bond between the lecturer and the student. They demand a feeling of immense respect

on part of the student and care and tenderness on part of the instructor for developing a balanced personality (Lateef, Dahar & Yousuf, 2019).

Teachers using a modular approach in mathematics teaching can judge the difference among students' mastery level. Being a student-centered approach helps to motivate the pupil in gaining more skills in the field of problem-solving. Students show their interest in the learning methods such as the use of group discussion, acquiring new knowledge, written notes, solved example sheets and use of information communication. Therefore, the researcher has developed teaching modules to overcome the students learning problems, lack of interest and academic performance.

Students work most effectively at the task in which they are genuinely interested. Self-directional material and application of ideas in various situations can enhance the focus the teaching-learning process within activity generated by modular approach results in cognition promotion (Singley & Anderson, 1989).

Statement of the Problem

Mathematic teaching in Pakistan is mostly kept teacher-centered, learners lack in handling mathematical reasoning with self-directed activities. The modular approach possesses the potential to generate understanding of students by retaining concepts to their memory. When the method of teaching is changed, there is an effect on the learning of the students. So, this research attempted to have an experiment by application of this approach for the teaching of mathematics at grade 10th in comparison with the traditional method.

Objectives

1. To develop a module for teaching mathematics in grade 10th.
2. To give a comparison between the academic achievement of control & experimental groups treated through traditional & modular approach.
3. To study the development of selected teaching methods and introduce advanced methods through a modular approach.

Literature Review

According to the Australian Curriculum Studies Association (2001), human beings always wanted to transform their values, norms, culture,

religious norms, and experiences to the next generation. Ultimately, education is considered the backbone of this transformation.

When modules are being designed and specifically, it is important to look at the module holistically and decide on module level strategies and principles as well as knowledge pedagogy which is important for the learners. This should include consideration of module-level learning, teaching and assessment strategies and content pedagogical approaches.

Yadav (1992) elucidated that everyone has been trying to understand and attain the changes going around them and perceive high numbers of impressions through various senses. After getting accumulated information through communicative ability from the surrounding, then organize information tried to transmit to the next generation.

Remillard (2005) elaborated that learner's ability is not a slight endorsement of expertise by conferring a precise quantity of education to students. An instructor is the faultless and model to be trailed by understudies. He is a means to the entire schooling process. A mentor has to be such a man who orders the regard of understudies by the morality of what he is (Khan, Arif & Yousuf, 2019). He must grab the importance of schooling and its association with society. Biggs (1994) suggested that at this point the knowledge of learners is mainly focused or reliant upon the instructors' ability in transferring information, the consideration is on lectures' intellectual and additional qualities that directly affects learners' knowledge. Elements that will be integrated are the supremacy of instructional capabilities, continual employees' improvement and consumption of aids that might improve instructing capacities. Collette (1986) said that individualized instruction is the subcategory of a modular instructional approach that provides a broad vision and opportunity for learners to achieve their goals and accept the responsibility for fulfilling their educational tasks at their own pace and evaluate their performance in the field of education.

Global Monitoring Report (UNESCO, 2005) highlighted the pedagogical development for learning among learners includes arranging creativity; promote educational behavior and social development as preferred indicators of quality learning. Concerning a wide number of studies on pedagogical knowledge and content, it reflects a clear demand for setting such instructional material that may provide conceptual learning among students. The arrangement and flow of activities provide a chance to achieve inter-linked objectives of the level of cognition and its application into other domains.

Collette (1986) presented that modules are mini courses that are well planned and well structured, these lessons which are in the form of

module learners get more knowledge rather than the traditional method. According to Ansari and Maryam (2000) “module” is strictly connected towards flexible of idea and reliable to instructional language, which is ought to launch such instrumentation that is capable for achieving our objectives of instruction in more functional manners.

Cross (1996) illustrated that instructors are directed to design the activities for students into such frames that their attempts are linked with proper timely feedback with a greater chance of effective learning. This also provides improvements for the reattempt of such activities with mastery of learning. Ramaprasad (1983) described opinion and interest level as major indicators of difference between academic achievements to the specific and general objectives of learners.

Stiggins and Chappuis (2005) illustrated that generally, teachers believe that the possible and most relevant information which is gathered from the learners by taking achievement test and arranging activities is essential in boosting up the academic performance of students. A modular system is an educational system and its curriculum is made by modules. Different parts of modules are arranged step by step and these steps complete each other.

Sombilon (2011) elucidated that module is prolific by simply defined population, there are single and multipurpose concepts, specified performance and content is selected only as it relates to the achievements of the work efficiency. It also includes integrated or supplementary instruction. Different strategies in the module might orient the learner to doing the task alone in tiny groups attend large group presentations. It leads to continuous reinforcement, adequate practice, relevant evaluation, and field testing are also essential parts of the module. Sejpal (2013) presented “A teaching strategy is a learning plan and it includes the presentations which the teacher might make, the exercises and learning activities designed for students, AV-aids which will be supplied or suggested for students to work with, in which they show off their growing understanding and capability will be collected.” Bedaure (2012) studied instruction designed on a module to observe the achievement for a particular subject. It occupied both tests to control group design for experimental study. Stiggin & Chappius (2005) told that research on the effectiveness of the modular approach in mathematics teaching the technology plays a vital n interesting role in learning. Technology makes the lesson effective and as well as a classroom for both teachers and students.

According to Remillard (2004), mathematical modules on different themes are developed by functional teachers. A similar pattern, environmental & economic themes are displayed through modules strengthening the social workers to interact with masses. Adibnia (2010)

presented that modular teaching is one of the widest ranged methods of teaching in Australia, the US and as well as other Western developed countries including the Asian region. Similarly, Modules are day by day becoming very popular in various fields of teaching like pure science, Biological Sciences, Medical sciences as well as mathematics. Even in social sciences and computer studies, these are in practice.

Malik (2012) find out that the performance of learners express with the modular approach in teaching is better than those learners who taught by the traditional approach. The study reveals that systematic instruction greatly affects the general comprehension of learners. Skovsmose (2005) illustrated that to know about the purpose and process of utilization of modules with deeper meaning, it is to understand that no method is perfect to be utilized for each subject and topic. It is more important to go for its selection by keeping its limitation as well.

Research Hypothesis

The study hypothesized that

- (a) H_1 : The scores of groups treated by the modular approach will be higher than those students taught by the traditional method.

$$H_1: \mu_E > \mu_C$$

- (b) H_1 : The mean scores of groups treated by the modular approach will not be greater than those students taught by the traditional method.

$$H_1: \mu_E \neq \mu_C$$

Methodology

The researchers used experimental research techniques, as this method is a useful fact-finding approach with adequate elucidation and analysis. This experimental study used a quantitative method to find out the accuracy and ensuring the validity of data. The experimental method helped in find out academic achievement, distribution, comparison, calculation, and exposition. The pre & post-test design was followed for investigation of the efficiency of the modular approach for mathematics teaching and was compared with most traditional teaching.

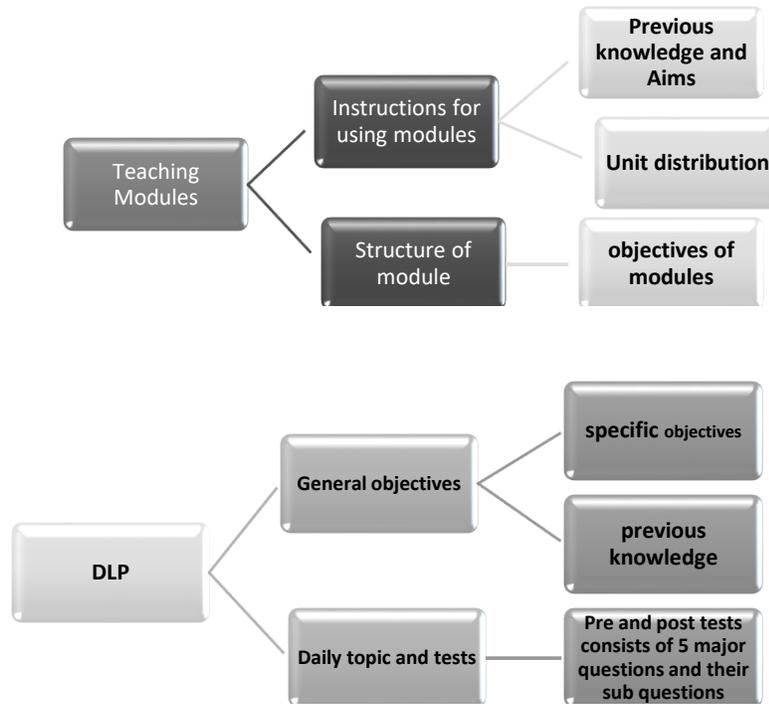
Nature and Size of Sample

Through simple random sample technique, fifteen learners constituted section A of class 10th as the experimental group (Group A)

and fifteen students constituted section B of class 10th as (Group B, control group) at the selected site of secondary school.

Development of Tool

Pre & post-tests were arranged by considering objective and subjective type tests including items of definitions, short solution answers, long questions, and conceptual questions. Moreover, similar questions were used in the pretest and posttest question papers. The above-mentioned test was developed for the subjects of Mathematics at secondary level on topics; Frequency Distribution, Frequency in mathematics, Simple distribution, Construction of frequency table and its types, Construction of histogram with equal and unequal class intervals, construct cumulative frequency, Class boundaries, central tendency and Measure of dispersion.



Data Analysis

It deals with the statistical interpretation of collected data through post-test and pre-test calculated to the groups of the sample. These two groups were control and experimental. The experimental group was denoted by group A and the control group was denoted by group B. The whole data calculated by t-test. It was used as figures or mathematical instruments to calculate the significant difference between the achievement of learners taught by the traditional technique and modular technique. In this study applying means, standard deviation, t-test and degree of freedom were calculated from the same data.

Results

Following are the results of the study:

Table 1

Comparison of pre-test scores control group and experimental group

Group	N	Mean	S.D	t-value	p-value
Control	15	4.6667	2.25726	-4.743	0.001
Experimental	15	9.4667	3.20416		

In table 1, the data from comparison of marks between both groups, control and experimental and shows that the mean of both groups the first was the control group and the second was experimental group is 4.6667 and 9.4667 respectively. An equal number of learners were considered for two groups, 15 students were in the control group and similarly, 15 students were in the experimental group.

The standard deviation in the pre-test of the control group was 2.25726 and the standard deviation of the experimental group 3.20416. The calculated value of t was -4.743 which is lesser than table value 2.01. A negative sign implies that the sample mean is less than the hypothesized mean. the p-value is derived by the t value and degree of freedom for upper tail areas for central t- and distributions, which is 0.001 respectively. It ascertains our null hypothesis and shows that there was no significant difference between the academic achievements of both groups in the Pre-test.

Table 2

Comparison of post-test scores control group A and Experimental group B

Group		N	Mean	S.D	t-value	p-value
Posttest	Control	15	15.8667	4.15532	-15.086	0.002
	Experimental	15	35.6000	2.89828		

In table 2 the data from comparison of post-test marks control group A and Experimental group B shows that the mean of both groups the first was the control group and the second was experimental group is 15.8667 and 35.6000 respectively. the p-value is derived by the t value and degree of freedom for upper tail areas for central t- and distributions, which is 0.002 respectively. The number of learners in both groups was also equal in the study. 15 students in the control group respectively, the same students were in the experimental group. The standard deviation in the pre-test of the control group was 4.15532 and the standard deviation of the experimental group 2.89828. The interpreted value of t was -15.086 which less than table value 2.01. It shows that there was a significant difference between the academic achievement of the control group and the experimental group in the Post-test.

Table 3
Independent Sample Test

Test	Group	f	Sig.	t-value	df	Mean	Standard Deviation
Pre-test	Control Experimental	1.385	.249	-4.743	28	9.4005	49.16

In table 3, the calculated value of “t” was -4.743 which is lesser than table value 2.01. The degree of freedom in the pre-test of control group A and Experimental group B was 28. It ascertains our null hypothesis and shows that there was no significant difference between the academic achievements of both groups in the Pre-test.

Table 4
Independent Sample Test

Test	Group	f	Sig.	t-value	df	Mean	Standard Deviation
Pre-test	Control Experimental	2.682	.113	15.086	28	33.7	615.7

In table 4, Independent sample test shows that the calculated value of t was 15.086 which was not lesser than table value 2.01. The degree of freedom in the pre-test of both groups was 28. It ascertains our null hypothesis and shows that there was a significant difference between the academic achievement of the control group and the experimental group in Post-test.

Discussion

Self-contained modules were used for individualized instruction of learners. But step by step these modules were developed in such a way to use for tiny group's self-instruction. Modules also developed the interest towards mathematical thinking and concepts among learners and helped to achieve good scores in tests rather than the traditional way of teaching. In this study, an experiment was done to inquire into the effectiveness of the modules, comparison among students. Fifteen students were taught by an efficient application named "modular approach" and the other 15 students were taught by the traditional approach. Consequently, students performed very well who they are taught by some modules rather than those students who they are taught by the traditional method.

In the post-test performance of the experimental group was better than the control group. This study is compatible with the study of 1 and Rao (1981). Students learn more through the modular approach because of its uniqueness and modification and this study congruent with the study of Sejpal (2013). Modular approach becomes very popular in almost in all variety of subjects like natural science, specifically in biology and medical education and even in social sciences as well as in computer education. It concerns the individual differences among the learners which make necessary the planning for the adoption of the most appropriate and innovative teaching techniques in respect to help the individual grow and develop at her/his own pace.

According to Aqazade (2009), mathematics courses have been failed by many students because mathematical tasks need an accurate and pinpoint decision-making ability which is unknown to these students. In learning mathematics, a wide variety of methodology influences a learner's attitude.

Conclusion

It is concluded from finding and discussions that the experimental group student achievements are better than control group students in the post-tests of modules. After treatment, those achievements rejected the null hypothesis and showed the vivid significant difference between the achievement test of the students included in the control group and the experimental group. The effectiveness of the modular approach in the subject of mathematics becomes revealing and significant when compared to the experimental group.

Despite the basic and essential unit of curriculum, it was concluded that the majority of the students face problems in mathematics. Like other subjects that may be a rote memorized material to some extent, mathematics is not. It creates a complete, logical and structured learning process and abilities.

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