

To Determine the Effectiveness of Modular Approach in Teaching Matter and Change in it's States in General Science for Elementary Classes

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Abstract

Module is a unit of work in a course of instruction that is virtually self-contained and a method of teaching that is based on the building up skills and knowledge in discrete units. Module is self-instructional package; it enables the learner to learn independently. The aim of this study was to investigate the effectiveness of modular approach in teaching matter and change in its states in general science for elementary classes. The major objectives of the study were (i) to determine the role of modular teaching in the academic achievement of students of science at elementary level, (ii) to find out whether the modular teaching is more effective than traditional methods. Study design was pre-test and post-test. All class 5th elementary school students studying general science subject were constitute the population of the study. 40 Students of class 5th studying in general science subject from Govt. Girls Primary School Ziarat Kaka Sahib No. 1 were served as sample of the study. Pre-test and post-test were used as research instrument and data was collected through

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pre-test and post-test. Collected data was analyzed and interpreted using T-test through SPSS. The analysis of the collected data revealed the following findings. Treatment of modular approach had great effect on experimental group and its academic achievement was better than that of control group. Teaching of G. Science through modular approach was more effective than traditional teaching approach. The study testified a collection of positive outcomes during application of modular approach. Therefore, elementary school teachers may use modular approach in science to improve the academic achievement of students. It is recommended that teachers may be recognized high level of communication through questioning as it endorses participation enhances learning and inspires students. It is recommended that teachers and students should follow modular approach to get maximum benefits from this innovation. Teachers training institutes may make modular approach as a part of their curriculum content and teacher educators may be trained in different model of modular approaches.

Keywords: Module, Modular Approach, General Science, Elementary Level.

Introduction

The tendency to use module in teaching learning process is become very popular in recent times in modular approach instead of traditional textbook the teacher use modules teaching which are prepared for specific purpose (Mercedes, 2009).

In many countries including western countries and Asian areas modular teaching is one of the most extensive and acknowledge teaching learning techniques, modular approach is used in many subjects like natural science specially in biology and medical education even in social sciences as well as in computer education .in order to help the individual to grow and develop at his/her own speed for that purpose this approach consider the individual differences which make necessary the planning to embrace the most proper techniques (Sejpal, 2013).

A module is a combination of learning opportunities which are well ordered around well-defined topic which restrain the components of instruction, specific instructional objectives, teaching learning activities and evaluation using standard. Modules are developed within a course or programme texture not only in separate way (Ali, Ghazi, Khan, Hussain & Fatima, 2010). For the first time the concept of module arrive into secondary school curriculum through the report of Munn. The modular approach has been comprehensively qualified by Scotland Action plan report. In England and in Wales this document put great effect on pre 16 curriculum thinking (Shaheen & Khatoon, 2017).

Modules are the best option for student centered teaching and learning to be used as learning materials inside the classroom. Modular approach is being extensively utilized for designing courses of higher educational teacher training programs building of capacity and human

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resource development programs/workshops. Literature review shows thorough researches at international level on modular approach and dearth of researches at national level. The modular teaching approach demonstrate more useful and provide more positive results on students' moral sense development than traditional approach. Male and female students of experimental group reached to the post conventional level of Kohlberg's theory of moral sense development (Mizrachi, 2010).

Related Researches

Module is derived from Greek word "Modus" which meaning a manner of working with some instructional materials, modular approach is larger than a session but smaller than the preparation of course is an instructional plan (Kulkarni, 2021). Modules are necessary self-contained, self-instructional package and self-speed materials which applied by students (Dejene, 2019).

Jackson (2011) has well utilized modular approach by dividing all ten chapters of book named 'Research Methods' into twenty modules by using a modular approach. Brown and Lewis (1997) indicated that modular are not only used in educational organizations but also used outside the classroom and describes its importance of modular approach. These modules are very pliable and can be implemented through an enclosure of patterns for individual or group users.

According to Salandanan (2001) in modular approach, the climate convert from teacher centered to learner centered module gives confidence and judge self-determination in learning. According to Galton and Moon (2018) abrupt exceed in information and crowded classes of students disconnection with educational system and insufficient budgetary resources, all these make it compulsory to identify more fruitful and efficient instructional methods.

Sadiq and Zamir (2014) investigated the effectiveness of modular approach in teaching at university level. She finds out that, Modular teaching is more effective in teaching learning process as compared to traditional teaching methods. Modular approach helps to maximize the chances of students' participation in classroom in respect to fulfill the given tasks at the spot. So the students free to learn in their own pace.

Ansari and Malik (2013) worked on modular approach to find out the effects of modular and traditional approaches on students' general comprehension. Conclusions of this study showed that there were significant differences between modular and traditional in general comprehension of students. Depict that students taught through modular approach gained higher mean score than students through traditional approach.

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Statement of the Problem

Modular teaching strategy is an effective technique for students to learn General Science. The problem under contemplation was to find out the effectiveness of modular teaching approach on learning of elementary school students of District Nowshera.

Objectives

The research study aimed at:

- To determine the role of modular teaching in the academic achievement of students of G. Science at elementary level.
- To find out the modular teaching is more effective than traditional methods.

Hypotheses

The hypotheses were as:

H₀1. There is no significant difference between the mean scores of experimental and control groups in pre-test.

H₀2. There is no significant difference between the mean scores of experimental and control groups in post-test.

Method and procedure

Population

All elementary school students studying in general science subject were constitute the population of the study.

Sample

40 Students of class 5th studying in general science subject from Govt. Girls Primary School Ziarat Kaka Sahib No. 1 were served as sample of the study.

Research Design

This student was conducted to find out the effectiveness of modular approach on teaching in G. Science for elementary classes pre-test. Post-test design was used in this research study in the present study two groups were formed i.e. experimental and control groups.

Diagram for Research Design

Group	Random Assignment	Pre-test	Treatment	Post-test	Retention test
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E	R	Q1	X	Q3	Q5
C	R	Q2	-	Q4	Q6

Key:

- E = Experimental group
C = Control group
R = Randomly selected
O₁ = Observation of experimental group on pre-test
O₂ = Observation of control group on pre-test
O₃ = Observation of experimental group on post-test
O₄ = Observation of control group on post-test
O₅ = Observation of experimental group on retention test
O₆ = Observation of control group on retention test
X = Treatment provided to experimental group in the form of modular approach (Farooq & Tabassum, 2017).

Research Instrument

Teacher-made test was constructed by one working teacher of G. Science. Three teachers give comments on this test. In the light of comments and suggestions, the test was revised. In this test, some corrections were made. For validation, this test instrument was submitted to a team of three experts. Experts proved the validity and verification of this test. Now this test was ready for administration on selected sample. Students of G. Science grade 5th were randomly selected and randomly assigned to experimental and control group.

This teacher-made test was used as:

- Pre-test
- Achievement post-test
- Retention test.

Treatment

- Treatment of G. Science unit through modular approach was given for a period of six weeks to the experimental group. Modules were provided to students to learn the content of G. Science subject through these modules without the help of teacher.
- Students were directed to work individually and complete the given stages in the specific time. If they need the help or supervision of the teacher at any stage, they can get the guidance of the teacher anytime at any stage. On the other hand, control group taught through

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traditional teaching methods. In the method, students only used textbook just read and complete the exercises.

- Next day following the completion of treatment period, teacher-made achievement post-test was conducted. Post-test consist of same items as that of pre-test. Just the sequence of item was changed. Post-test was conducted the same day, same time in the same environment for all experimental and control groups.
- Teacher-made retention test was conducted on the same day, same time and in the same environment for experimental and control groups.

Procedure

- A teacher-made test was conducted for two groups i.e. experimental and control groups. These pre-test were checked, score and rechecked by the researcher to find out whether all students were similar before the start of treatment.
- Events of instruction given by Gagne and Briggs (1974) were used for designing of learning experiences with little alteration. A template was formulated which was based on Gagne events of instruction. This template was rigorously discussed and reviewed by the supervisor. This template was further improved in the light of suggestions and recommendations provided by the supervisor. Subsequently, a researcher developed six modules of G. Science from the initial chapters of textbook which was related to the following chapters.
 - i) Classification of living things
 - ii) Seed structure and germination
 - iii) Microorganisms
 - iv) Pollution
 - v) Matter and changes in its state
 - vi) Friction and machines
- Concepts presents in these chapters were modularized in order to make the content self-study material. Each module was complement with in-built assessment and its solution.
- Attractive pictures related to each concept were added. Activities and experiments were mentioned to teach each module. These modules could be used either on students pace or teacher's pace. Modules were made students centered having a lot of interactive exercised based on multiple intelligences like writing of reflective journals of modules involving intrapersonal intelligence, assessment involving logico-mathematical intelligence performing practical experiments intelligences and asking questions using linguistic intelligence. Finalized modules were submitted to experts committee of three members. One

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of the modules (Classification of living things) was piloted on ten students of GGPS Ziarat Kaka Sahib No. 1, which were not included in selected sample during teaching of G. Science through module observations, noticed by the teacher which were communicated to researcher. Researcher reconstructed the modules. Finally all modules were submitted for verification committee. These modules were verified and validated by a committee of three members for implementation on selected sample.

- Different activities and experiments related to the selected nits of G. Science subject were added in these modules.

Data Collection

Two different treatment designs were implemented before starting experiment. Lessons plan for control group and module for experimental group inscribed the same instructional objectives which were based on the similar exercises and reading transit. However, modules for experimental group provided opportunity for students. To do work individual according to their own pace, contrarily control group students worked in group and split their answer with the class. Textbook/workbook which was provided to control group with conventional routine situation in the classroom and on the other hand, experimental group was provided with modules as treatment. The experiment continued for six weeks after the treatment was over, post test was administered to measure the achievement of the sample students. Data to equate the control and experimental groups, while post test score served as data to measure achievement of the students as a result of treatment. After a gap of one month, the post-test was again administered on sample students as retention test.

Data Analysis and Findings

All test items were entered into SPSS and results were analysed in the light of hypothesis. T-test was used to analyses the data. Results obtained by statistical analysis were tested on 0.05 level of significance.

Descriptive Statistics:

Table 1: Post-Test Marks

Dependent Variable: Obtained Marks in Post-test			
Group	Mean	Std. Deviation	No.
Controlled Group	30.15	5.761	20
Experimental Group	43.00	2.920	20

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Total	36.58	7.916	40
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Table 1 revealed the mean and standard deviation for obtained marks of students of both groups on post-test. The average marks obtained by students for control group (30.15) is less than Experimental Group (43.00), which indicates that the performance of Experimental group is much better than Control Group. Also the standard deviation of Experimental Group (2.92) is less than Control Group (5.761), which indicates that the spreadness in obtained marks of control group are more that of Experimental group. So using descriptive statistics approach the study revealed that the Experimental group is much better that of Control group.

Table 2: Summary of Statistics

		STATISTICS			
		Obtained Marks on Pre-test of Control Group	Obtained Marks on Post-test of Control Group	Obtained Marks on Pre-test of Experimental Group	Obtained Marks on Post-test of Experimental Group
No	Valid	20	20	20	20
	Missing	0	0	0	0
Mean		18.30	30.15	18.85	43.00
Median		18.00	31.00	19.00	43.00
Mode		18	30	18	40
Std. Deviation		1.174	5.761	.933	2.920
Minimum		17	11	17	36
Maximum		21	38	20	47
Sum		366	603	377	860

Table 2 revealed the summary statistics of students obtained marks in control group as well as Experimental group. The 1st and 2nd column represents the summary statistics of control group on pre-test and post-test respectively as well as 3rd and 4th columns represent the summary statistics of Experimental group on pre-test and post-test respectively. The average marks (mean, median and mode) of control and experimental group on pre-test are approximately equal, while after applying a special treatment to Experimental group, the average marks (mean, median and mode) of the experimental group are more than control group on post-test. All the results on pre-test for control and experimental group were

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approximately equal, while after applying treatment to students, each of summary statistics for experimental group gets more increase rather than control group. The sum of obtained marks of control and experimental group on pre-test are approximately equal, while sum of experimental group is greater than control group on post-test, which indicates that the students after getting the treatment in experimental group improve their ability of getting highest marks. Therefore, one concludes that the treatment assigned to students in experimental group is more effective.

H₀1. There is no significant difference between the mean scores of experimental and control groups in pre-test.

Table 3 Significant difference between the mean scores of experimental and control groups in pre-test

Group	N	Mean	V	df	t-value	Significance (2-tailed)	Effect
Pre-Experimental	20	18.85	0.87	38	1.63	0.109	Not Significant
Pre-Control	20	18.3	1.37				

Significance level = 0.05,

Table Value = 2.024

Table 3 depicts that the calculated t-value 1.63 was lesser than table value 2.024 which were not significant at significance level (0.05); hence the null hypothesis is accepted. It means that before the treatment control and experimental group were same and there was no significance difference between pre-control and pre-experimental groups.

Table 4 There is no effect of modular teaching on students' academic achievement

Group	N	Mean	V	df	t-value	Significance (2-tailed)	Effect
Pre-Experimental	20	18.85	0.87	19	38.36	0.00000000	Significant
Post-Experimental	20	43	8.52			018	

Significance level = 0.05,

Table Value = 2.093

Table 4 indicates that the calculated t-value 38.36 was greater than table value 2.093 which

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were significant at significance level (0.05); hence the null hypothesis is rejected. It means that modular teaching has significance effect on students' academic achievement.

H₀₂. There is no significant difference between the mean scores of experimental and control groups in post-test.

Table 5 Significant difference between the mean scores of experimental and control groups in post-test

Group	N	Mean	V	df	t-value	Significance (2-tailed)	Effect
Post-Control	20	30.15	33.19	38	8.89	0.0000000000 8	Significant
Post-Experimental	20	43	8.52				

Significance level = 0.05,

Table Value = 2.024

Table 5 depicts that the calculated t-value 8.89 was greater than table value 2.024 which were significant at significance level (0.05); hence the null hypothesis is rejected. It means that there is significant difference between the mean scores of experimental and control groups in post-test.

Table 6 Retention Test Experimental

Group	N	Mean	V	df	t-value	Significance (2-tailed)	Effect
Post-Experimental	20	43	8.52	19	1.45	0.162	Not Significant
Retention	20	43.2	8.16				

Significance level = 0.05,

Table Value = 2.093

Table 6 indicate that calculated t-value 1.45 was lesser than table value 2.093 which were not significant at significance level (0.05); Hence, It means students treated with modular teaching can retain the knowledge and had significant effect.

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Table 7 Retention Test Control

Group	N	Mean	V	df	t-value	Significance (2-tailed)	Effect
Post-Control	20	30.15	33.18	19	0.325	0.748	Not Significant
Retention	20	30.2	33.64				

Significance level = 0.05,

Table Value = 2.093

Table 7 shows that the calculated t-value 0.325 was lesser than table value 2.093 which were not significant at significance level (0.05); hence it means students treated with traditional teaching method can retain the knowledge.

Discussion

A study was carried out to investigate the effectiveness of modular teaching approach on learning of elementary school students of District Nowshera. Modular teaching is an innovative teaching approach in classroom sceneries, for ordering learning proficiencies in education and it has been being paid copious responsiveness. The approach of learning modules has become a necessary part of smooth teaching in all sort of education. A learning module is a self - learning suite which deals with one explicit focus material/ component. Modular Approach can be used in an environment suitable to the learners according to their learning speed and pace. There are several theories available which advocate modular approach to be applied in practical classroom situations. For this purpose, a study was conducted in order to check the effectiveness of modular approach in the subject of science at primary level. The data was obtained on pre-tests, post-tests. The obtained data was analyzed and interpreted.

The findings of this study indicated Module was very effective as compared to traditional teaching. This finding was stable with the study conducted by Nair (2005) who found that the essential constructivist approach could be applied to other sciences social subject. This finding was also reliable with the findings of previous studies as done by Lesh and Doerr (2003) which stated that the use of this approach is able to familiarize students with problem solving and higher order thinking skills. This finding was in line with research done by (Matanluk, Mohammad, Kiflee & Imbug, 2013).

The used of CSAA module managed to increase understanding, knowledge and interest of

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students in Geography (Lesh & Doerr, 2003; Gagnon & Collay, 2001). Radical constructivist approach in teaching and learning was more students centered and materials based. Therefore, students were actively involved in the process of problem solving (Matanluk, Mohammad, Kiflee & Imbug, 2013).

The teacher might only act as facilitators who guided students in teaching and learning process (Raman, 2006). Active participation by students was due to student centered strategies and student-oriented activities could produce positive thinking, information and knowledge. In addition, the findings based on 19 student records, Student 3 and Student 24 showed that activity based on problem-solving task gave them a space to exchange answers and defend their arguments.

According to Verdi, Crocks and White (2002); Puachaream and Fisher (2006) performed in the group activities enable students to collaborate with others. In addition, teachers should encourage students through inquiry and encouraged students to question other students. Therefore, in the constructivist classroom the teacher must provide a challenging task according to students' ability and provided space for discussion. Through discussion students had the opportunity to share their ideas to others. At the same time, students could build their knowledge (Tileston, 2000).

Barnes, Maye, Alfred and Hayman (2000) investigated that operationalization of modular approach helped in motivating the students and they benefited more from this approach. On the whole, it appears that modular learning group performs significantly better than the group taught by traditional method of teaching. This increased motivation was linked with setting of short-term objectives and the intensity of teaching approach. The Modularization also promoted positive changes in teaching style. The positive results of the study can be examined further by conducting this type of researches in rural areas and in female schools. Before introduction of modular teaching at large scale in schools it is imperative to arrange in-service training of teachers along with preparation of modular instructional material. This study was deficient in respect of content covered and time used. The quality could be improved if more resources were available. Anyhow the results of the study are sufficient for generalization of teaching methods.

This research study has conducted to investigate the "effectiveness of modular approach of teaching science to elementary school students." Module is a unit of work in a course of instruction that is virtually self-contained and a method of teaching that is based on the building up skills and knowledge in discrete units. Module is self-instructional package; it enables the learner to learn independently. The subject of science is very crucial at elementary level. As science is an innovative subject based on several theories into practical

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shape and is very interesting. It is necessary both for teachers and students to learn much more at this stage. The subject of science requires special methods for teaching. It has been observed that students do not show keen interest in science. One of the main reasons is the traditional method of teaching. Traditional methods minimize the benefits of science. Therefore innovative methods may be used to grab the needs of science education. The researcher used modular approach to investigate its effectiveness in science. The major objectives of the study were (i) to determine the role of modular teaching in the academic achievement of students of science at elementary level, (ii) to find out whether the modular teaching is more effective than traditional methods. To achieve these objectives, the following null hypothesis were tested; (i) There is no significant difference between the mean scores of experimental and control groups in pre-test, (ii) There is no significant difference between the mean scores of experimental and control groups in post-test. Study design was pre-test and post-test. The study was conducted in the Government Girls Primary School No. 1 Ziarat Kaka Sahib. All Grade 5th students of district Nowshera were the population of the study. 40 students of grade 5th studying in general science subject were the sample of the study. Sample of the study was equally and randomly divided in to two groups (Experimental and Control group). Each group was consisted of 20 students. A pre-test was taken from both of the group. Both the groups were taught by the researcher. Conventional method of teaching was used to teach the control group while modular approach was used for the treatment group for the duration of six weeks. Equal number of lessons was taught to both the groups. At the end of six weeks' duration a post test was used to evaluate the effectiveness of the modular approach over the conventional method of teaching. Pre-test and post-test were used as data collecting instruments in this experimental study. The purpose of pre-test was to equate treatment and control group. While post-test was given to determine achievement of participants after treatment. Pre-test and post-test were same with different order of test questions. After obtaining the scores, the data were tabulated and the mean, standard deviation, differences between means were calculated. Significance of difference between the means scores of experimental and control on variable of these tests was tested at 0.05 by using t-test.

Conclusions

- The use of Modular approach in teaching of science at elementary level was more constructive than conventional learning.
- Modular approach has evidenced to be appropriate and offers itself to the instructions, we want for learning science at elementary level without any major shift in

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classroom organization and time table. Modular approach maximizes student education.

- The application of modular approach in school is reasonable through close association between the goals of citizenship education and societal skills stimulated by this learning strategy.
- Modular approach pledges students' active participation in the teaching learning process owes a great deal for better students' accomplishment.

Recommendations

- The study testified a collection of positive outcomes during application of modular approach. Therefore, elementary school teachers may use modular approach in science to improve the academic achievement of students.
- This study was conducted in girls' school in Pakistan at elementary level. Furthermore, conducting similar study in boys' school and at any level would worth presenting.
- The present experiential study was conceded to examine the effect of modular approach in teaching science. Such studies are needed to be conducted in other subject's area such as English, Mathematics and social science etc.
- Studies on modular approach provide a widespread field of research if we observe the comparative effectiveness of different modular approaches. Consequently, researchers should also ruminate this feature of research.
- It is recommended that teachers may be recognized high level of communication through questioning as it endorses participation enhances learning and inspires students.
- It is recommended that teachers and students should follow modular approach to get maximum benefits from this innovation. Teachers training institutes may make modular approach as a part of their curriculum content and teacher educators may be trained in different model of modular approaches.
- Training may be provided through refresher courses to in-service teachers to instruct them in application of modular approach, so that they can implement useful approach of modular approach instruction.
- Training programs are required to plan and develop for both teachers and their students, not just in modular approach methods but also in other teaching methods including e-learning, CAI, and personalized learning to study these innovations in practice.

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