EFFECTIVENESS OF ACTIVITY ORIENTED METHOD IN TEACHING SCIENCE TO VII GRADE STUDENTS

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ABSTRACT

The purpose of the research was to study the effectiveness of activity-oriented method in teaching science in students of in secondary classes. The Experimental group taught by activity-oriented method was compared with the control group which was taught in the conventional textbook approach. Retention test results of the two groups were compared in total and also objective-wise to find whether different types of activities has any significant effect on the retention capacity of students. The method used in the study is experimental method. The dependent variable is the achievement of students while the independent variable is the teaching method. The achievement test scores were analyzed in total and objective-wise and subjected to ANCOVA. In conclusion, we can say activity-oriented method was proved helpful to students in increasing the retention capacity in science. The study will definitely help teachers in choosing suitable activities for secondary students. The investigator also hopes that the present study may help in improving the curriculum of secondary classes.

Key Words: Activity Oriented Method, Effectiveness, Teaching, Science, Secondary School, Students, Retention, Textbook.

1. INTRODUCTION

Today science is progressing at a furious pace and it has surpassed all the miracles of mythology. There is not even a single area which is left out by the magical touch of science. By exploiting the inquisitive nature of man science goes on changing minute by minute and constructing new knowledge day by day.

There seem to be almost as many definitions of science as there are people attempting to define it. Undoubtedly, many possible viewpoints exists, each responsible for a different definition. Almost sixty years back, Conant (1951) classified these viewpoints into two classes including 'static and dynamic':

> "The usual concern of static science is knowledge, especially of facts or principles, gained by systematic study; a particular branch of knowledge dealing with a body of facts or truths systematically arranged. In contrast to static, the dynamic view based on experiment, on a willingness to challenge old dogma, and on an openness to see the universe as it really is".

According to this description science is a 'living entity that evolves' and it is exciting. On the other side, 'science is knowledge or a system of knowledge'. This is not to deny this view of science because the concerned of a scientist not only on the professional people of the subject, but a common man as well. So, science is a way or path for the understanding of the world and this concept should be learns by general community, especially school children.

Science is often taught as a body of established facts obtained by infallible individuals (scientists) using infallible methods (particularly, the "scientific method"). Actually, scientific knowledge includes not only facts, which are truths and therefore indisputable, but also generalizations and theories which are subject to error and liable to change. To be scientifically literate a person should be able to identify that which is known for certain, that which is supported by strong evidence, that which is merely speculative, and a person should also be conscious of the ever changing nature of science.

The fostering of student understanding of science is a difficult task for teachers at the level of education. It is a matter of fact that children are not interested in anything so much as in activity, and we observed that education should be imparted through work or play. In order that we may garb the young pupil's attention and enable him to learn anything, we must make him do something. The teacher are thus justified in using whatever means they can to bring their pupils into closer touch with the activities of real life. Educationists have now realized that no education

can be completed which does not include learning to do something or the other. Skillful performance is the essence of educational perfection.

Teaching of science consists in the manipulation of the experience which it gives to the students, in such a way that they may be led to take their proper place in the social world after they have left the school. While learning science, the students 'should be able to solve problems independently and to apply the theories learnt in practical situations. S/he should develop a scientific attitude, interest and curiosity. We cannot develop these qualities by giving only factual information. Students gain a lot by doing experiments individually and also in groups. The discussions, experimentation, observations all help the students to attain higher educational objectives. By promoting activities which engage students and requires them to participate in the approach to learning which both skills and attitude based.

Activity-oriented method is very effective in teaching science. Much research has been done in this area. Almost all of the research indicate activity-oriented method as superior to conventional approaches in teaching not only science but also many other subjects.

Activity curriculum means “curriculum design in which the interests and purposes of children determine the educational programme of activities being planned co-operatively by teacher and pupils” and activity learning/ teaching means “any learning or teaching situation, such as project work which is characterized by participation on the part of learner, as opposed to passive learning of information from a lecture, talk or observed demonstration" (International Dictionary of Education).

Activity curriculum is also called 'Project curriculum or Experience curriculum' whereas its origin can be traced back to the beginning of the twentieth century, its fundamental ideas date back to Rousseau and a few others as far back as even to Plato. In1897, Dewey used the term 'Activity Programme', a form of activity curriculum. In the same year, Dewey established a laboratory at the University of Chicago which was a joint venture of parents, teachers and educators. This approach thus provides a sound base of experimental background. According to the opinions of Bruner, Piaget and other advocates of scientific revolution, the children are to be

given first hand experiences suggested under play category. This approach also, especially in the developing countries, is likely to close the gap between elementary knowledge and the advanced knowledge.

According to Ediger, 1996 it is important for the science teacher to provide a variety of learning activities for pupils. Traditionally the principal aim of practical work has been to help the pupil to understand the theoretical ideas being taught by the teacher. Finagrin and Ingram (1988) explain many opportunities to allow pupils to experience science phenomena solve problems and develop laboratory and analytical skills.

There is a belief that all types of activities may produce significant difference in achievement when compared to conventional textbook approach. There are also many other defects for conventional textbook approach. It is wrong to assume that the student may be familiar with a particular topic if she/he can state it verbally. The student will master the content only if it is discovered through activities. The investigator hopes that activity-oriented method will help to increase the knowledge and its retention by pupils. This particular study was undertaken with this objective in mind.

2. OBJECTIVES

Following were the main objectives of the study:

1. To find out the achievement of pupils when taught by activity oriented method.

2. To find out the achievement of pupils when taught by conventional textbook approach.

3. To compare the achievement of pupils taught by activity-oriented method with conventional textbook approach.

3. HYPOTHESES

This study was guided by the following hypotheses:

Hypothesis No. 1: Activity-oriented method is more effective than the conventional text book approach in increasing the achievement in science of students in grade VII.

Hypothesis No. 2: The achievement of students of experimental group taught by activity oriented method is better than the achievement of students in control group at knowledge-level which clearly states that activity oriented method is more effective than conventional text book approach in grade VII Science class.

Hypothesis No. 3: The activity-oriented method is more effective than the conventional text book approach in increasing the understanding level achievement of students in science in grade VII.

Hypothesis No. 4: Activity-oriented method is more effective than conventional text book approach in increasing the achievement in science of VII grade students at the application level.

4. METHODOLOGY

4.1 Design

Experimental research differs from descriptive studies in which the researcher has some degree of control over the variables involved and the conditions under which the variables are observed. Experimental method provides much control and therefore establishes a systematic and logical association between manipulated factors and observed effects.

An experimental design to the researcher is what a blueprint is to an architect. It provides the researcher an opportunity for comparisons required by the hypotheses of the experiment and enables him to make a meaningful interpretation of the results of the study with the help of statistical analysis of the data.

The design selected for the present study is "Non-equivalent pre-test – post-test design. There are two groups (control and experimental) in this study and both groups are compared in achievement test.

In an attempt to conduct study on activity-oriented method, the investigator has tried to divide the students into ‘Experimental’ and ‘Control’ groups. Experimental group was taught by activity-oriented method which includes written experiences like selecting and copying relevant material from books, seeking information, making summaries, taking notes and drawing

diagrams. Practical activities such as setting up experiments, preparing charts and diagrams etc. were also given. Some visual activities like reading and interpreting charts and diagrams are also included. All activities were to be done individually. Many of the opportunities can also be used for assignment purpose (for the work sheets given by the investigators). The control group was taught by conventional textbook approach which emphasis only on textbooks and it is based only on theory classes which help to memorize the facts without any experimentation.

The investigators in the study have given maximum individual activities to experimental group except in cases where costly apparatus need to be used or adequate facilities were not available in the school. In such situations students were grouped into small groups of 3 or 4 students. Even in such cases the students were asked to record observations individually.

The investigator has tried to take theory classes and practical simultaneously. In experimental group there were no separate theory classes. This work can also be considered as an effort to bridge the gap between theory and practical. The usefulness of giving such individualized and group activities in a haphazard manner is never gratified. Giving activities to students without evaluating their effectiveness is worthless. This experimental study is a small step in this direction.

4.2 Variables

'Something that can change in value and can be measured is a variable. It can be an aspect of an experimental situation or a characteristic that changes in different individuals'. For an experimental study there are independent variables and dependent variables.

In this experiment the teaching method is the independent variable. The two strategies of independent variable selected by the investigator in this study are activity-oriented method and conventional text book approach. The control group is subjected to conventional textbook approach while the other groups, i.e. the experimental group are taught in the activity oriented methods.

The dependent variable used in this study is the achievement. It is measured by administering an achievement test after introducing the two strategies in the two different groups. The achievement of students in control and experimental groups are taken into account.

4.3 Tools and Materials Used

Following tools were applied during the study.

(i) Lesson Transcripts

The experimental group was taught using Activity-oriented method. For this, lesson transcripts were prepared which were purely based on activity-oriented approach. The format of the lesson transcripts was finalized after discussing with many experts. The valuable suggestions of many eminent educationists helped a lot in making the lesson transcripts purely activity-oriented. Ratho & Prakash (1996) describe various activities with examples which can be given in classroom situations. The investigators followed instructions provided by Young (1990) and Kennedy (1997).

(ii) Activity Sheet

Activity sheets are given to students of experimental group to encourage self-activity. In each lesson transcript more than two activity sheets were used. These work sheets can also be used for assessment purpose. The activity sheets prepared by the investigators are based on the work sheets described by Finagrin & Ingram (1998). Each activity sheet given by the investigator starts with simple questions and activities which are based on the previous knowledge of the students and then proceeds to new facts. The students learned through activities like doing experiments, observing real specimens, recording the observations and making conclusions. The conclusions given by the students are the new facts which were to be learnt. Since the activity sheet itself helps for necessary assessments, no separate column was given for 'Evaluation' in the lesson transcripts for experimental group.

(iii) Instruction Cards

Instruction cards are given to students of experimental group to do experiments and arrange experimental setup by the students. The ‘Instructions Cards’ along with the apparatus were given to each student. In some cases a single apparatus was used by a small group of students. But the written activities and observations were made independently. Because the study was conducted

in Grade VII, the investigator had to give guidance and support to students since they were not familiar with laboratory work.

(iv) Other Materials Used

Apart from Activity sheets and Instruction cards other materials used to conduct classes include apparatus and chemicals to conduct experiments, slides, specimens, models, pictures and diagrams for experimental group.

(v) Final Achievement Test

The achievement test prepared by the investigators was based on the chapter 4, entitled "Compounds and Mixtures" of Grade VII science book published by Harper Collins Publishers, London.[1] The final test comprises of 25 objective questions which should be answered in 25 minutes. Maximum marks were 25 (one mark for each question). The instructions for the students were given in the first page. All the questions were multiple choice questions with four alternatives. The first 9 questions were given as 'Fill in the blanks'. The next 9 questions were under 'choose the correct answer'. Question 21 was to give reasons and 22 to say true or false. Questions 23, 24 and 25 were based on diagrams. A separate answer sheet was given. Answers were to be marked by shading the circle corresponding to the correct answer. The weightage to content was finalized after discussing with experienced science teachers of the schools.

Three objectives - Knowledge, Understanding and Application of the Cognitive domain were tested in the Achievement test. Of the 25 questions, six (6) were in 'knowledge' objective (24%), eight (8) in 'understanding' level (32%) and eleven (11) questions were in 'application' level (44%). Since the method used was activity-oriented method, more application level questions were included. More questions under the objective 'application' were given in the draft test also (17 questions). But six (6) of them had to be removed in the process of standardization. Weightage given to objectives in the achievement test is given as Table-1 shown below.

[1] Absolute Science, Arnold, B., Jones, G., Jones, M. & Poole, E. (2002).

The questions were divided into easy, average and difficult based on the results of analysis of students' answer sheets in the draft test. Sixty percent (60%) of the questions (15 questions) were included as average questions while 5 questions (20%) were easy questions. The remaining 5 questions (20%) were difficult questions. Weightage to difficulty level of the achievement test is given in Table-2 below.

Reliability of the test is usually expressed by a coefficient of correlation which is called reliability coefficient. The reliability of the test was established by split-half method which is the method of splitting the test into two halves and finding the correlation between the two halves. All odd number items may constitute one test and even number items the second test. The scores of two halves were correlated and the reliability of the test was 0.76.

The face validity and content validity of the test was assured while preparing the blue print and giving adequate weightage to content and objectives. The opinion of experts in this field was taken into consideration while preparing the test and necessary modifications were made according to their suggestions.

Empirical or statistical validity of the test was calculated by correlating the scores of the test with marks of a recently conducted test obtained from the school. The coefficient of correlation obtained was 0.61.

4.4 Sampling

The study was conducted in Grade VII classes. The schools selected were located in Karachi, namely; Metropolitan Academy and Hashmat Memorial Higher Secondary School. The sample consisted of 219 students. By removing absentees in pre-tests and post-tests, the total number of students included in the study was 208 which were further equally divided (104 students) into experimental group and control group.

4.5 Collection of Data

Following are the major steps in the data collection:

4.5.1 Administration of Pre-test to experimental groups and the control group

The achievement test with 25 questions was given as pre-test. The pre-test was given to students of the two groups before experimental treatments. The score of the pre-test was tabulated (in total and also based on three objectives - Knowledge, Understanding and Application). The total and objective-wise scores of pre-test were necessary for the Analysis of Co-variance.

4.5.2 Conducting classes for experimental groups and control group

Two grade VII standard divisions from the same school were selected for the study. The experimental group was taught through activity-oriented method. The apparatus, specimens, activity sheets etc. were provided by the investigators. The classes were lively and students were very cooperative. The method helped to increase the interest and curiosity of students. The teachers of the school especially science teachers rendered good help to conduct the classes. The control group was taught by the conventional textbook approach.

4.5.3 Administration on Post-test

After teaching both classes in two different strategies, the posttest was administered. The total and objective vise scores of the two groups in this achievement test were found out. Total and objective-wise marks of the post-test (Achievement test) of these two groups were compared. The objectives selected by the investigator were knowledge, understanding and application.

4.6 Statistical Methods Used

For all the calculations Analysis of Covariance was used since it is considered to be the best statistical technique as it equates pre-experimental status of the groups. "Covariance analysis is especially useful to experimental psychologists when for various reasons it is impossible or quite difficult to equate control and experimental group at the start: a situation, which often obtains in actual experiments" (Garret & Woodworth, 1981). The pre-test scores and post-test scores of the experimental group and the control group (total and objective-wise scores) were compared using the statistical technique of t-test. Significance of difference between the mean scores of both the

experimental and control groups on the variable of pretest scores, posttest scores was tested at 0.001 level of significance.

5. FINDINGS

Comparison of performance of pupils in the experimental and control groups helped the investigators to arrive at the following findings:

Hypothesis 1: Activity-oriented method is more effective than the conventional text book approach in increasing the achievement in science of students in grade VII. The F value obtained from the Analysis of Covariance of the pretest and posttest scores of students of experimental group and control group was significant ($F_{y.x} = 68.24$, $p<0.01$) which is due to higher achievement of students in experimental group. The t-value between Total Achievement scores of experimental group and control group is 8.27 which is significant when tested for significance for df 1/132 ($p<0.01$). The adjusted means of posttest scores show that the total achievement of experimental group is significantly more than control group (Experimental group M = 22.15, Control group M = 18.25).

Table 1. Significance of difference between mean scores of the experimental and the control groups on posttest

Groups	N	Mean	SD	Fy.x	*t* value	Decision
Experimental Group	104	22.15	9.97	68.24	8.27	Significant at 0.01
Control Group	104	18.25	11.02			

Hypothesis 2: The achievement of students of experimental group taught by activity oriented method is better than the achievement of students in control group at knowledge-level which clearly states that activity oriented method is more effective than conventional text book approach in grade VII Science class. This conclusion is based on the findings that the F value obtained from the Analysis of Covariance of pre-test and post-test scores of students of experimental group and control group is significant at 0.01 level. ($F_{y.x} = 22.53$, $p<0.01$).

The adjusted means for knowledge-level score of experimental group and control group is 5.51 and 4.85 respectively and t value is 4.87 which is significant at 0.01 level. This clearly indicates

that the performance of students at knowledge-level of experimental group is significantly better than students of control group. Experimental group is taught using individual and small group activities while control group is taught through conventional text book approach.

Table 2. Significance of difference between mean scores of the experimental and the control groups on posttest

Groups	N	Mean	SD	Fy.x	*t* value	Decision
Experimental Group	104	5.51	9.97	68.24	8.27	Significant at 0.01
Control Group	104	4.85	11.02			

Hypothesis 3: The activity-oriented method is more effective than the conventional text book approach in increasing the understanding level achievement of students in science in grade VII. This conclusion is based on the finding that performance of students in experimental group who were taught in activity-oriented method is significantly higher than that of control group who were taught in the conventional text book approach. The following findings confirm this conclusion:

The F value obtained from Analysis of Covariance of pre-test and post-test understanding level scores of students in experimental group and control group is 8.98 which is significant at 0.01 level ($p < 0.01$). The adjusted means for post-test understanding level scores of experimental group and control group differ considerably (Experimental group-M = 7.20, Control group M = 6.63). The t value is 3.00 which is also significant at 0.01 level ($p < 0.01$).

Hypothesis 4: Activity-oriented method is more effective than conventional text book approach in increasing the achievement in science of VII grade students at the application level. The following findings prove this conclusion:

The F value obtained from the Analysis of Covariance of pre-test and post-test application level scores of students in experimental group (taught through activity-oriented method) and control group (taught through conventional text book approach) was found significant at 0.01 level (Fy.x value is 72.63, $p < 0.01$). The t value between experimental group and control group is 8.53 which is also significant at 0.01 level ($p < 0.01$). Adjusted means for post-test application level scores for experimental group is 9.36 and control group is 6.83.

Table 3. Significance of difference between mean scores of the experimental and control groups on pretest

Groups	N	Mean	SD	SE_D	*t* value	Decision
Experimental Group	104	34.50	6.32	1.68	0.22	Not significant
Control Group	104	34.14	6.22			

Table 3 indicates that the difference between the mean scores of the experimental group and control groups on pretest was found to be insignificant at 0.05 level. Because the obtained t-value is 0.22, which is less than the table value which is 2.01. Hence, the null hypothesis, "there is no significant difference between the mean scores of experimental and control groups on pretest" was accepted and both the groups could be treated as equal.

Table 4. Significance of difference between mean scores of the experimental and the control groups on posttest

Groups	N	Mean	SD	SE_D	*t* value	Decision
Experimental Group	104	67.71	9.97	2.80	4.48	Significant
Control Group	104	55.39	11.02			

Table 4 indicates that the difference between mean scores of the experimental and the control groups on posttest was found to be significant at 0.05 level. Hence, the declarative hypothesis, "Achievement of grade VII students in science when taught by activity oriented method is significantly higher than that of students taught by conventional textbook approach on posttest", was accepted, in the light of t-value (4.48) obtained which is greater than the, table value at 0.05 level (2.01). At posttest performance of experimental group was better than control group. These results support the concept of Rao, Bhaskara& Pushpalatha (1994) that activity based science teaching creates interest in children and they demonstrated significantly higher achievements than the individuals taught by traditional textbook approach.

6. DISCUSSION

The activity-oriented method will encourage the students to observe the nature carefully and this skill of keen observation will help them to understand the matter more clearly and precisely. The method also helps to correlate the theory and practical which is not possible in conventional textbook approach. According to this study the best results are obtained only when individual activities are given. The teaching method of using only large group activities (activities to the whole class like observing charts, seeing experimental setups etc.) have produced almost the same results as taught in the conventional textbook approach. In general, we can say activity-oriented method was helpful to students in increasing the retention capacity in science.

The activity-oriented method will help the students to learn the theory and apply the newly-acquired knowledge simultaneously. The conclusions of the study prove that the individual activity method has helped the students to score better in the achievement test. Both activity-oriented methods helped in increasing the retention capacity of students. The reason is that when the actual specimens are shown and when the major share of the practical work is done by the students, the content will be better imprinted in the students' memory. So they would be able to retain the matter for a much longer period than other students who are taught in the conventional textbook approach.

The fact that the activity method, though it has not helped in increasing the achievement of students, has contributed to increasing the retention capacity of students is worth mentioning. In the activity oriented method, the students themselves are learning the content while the teacher is playing only a passive role. "Learning by doing" is encouraged. The method is helpful in de-formalizing science education and also takes into account individual differences. Also, the role of the teacher and the students were equal.

The teachers also are encouraged to learn more and test their knowledge when activity-oriented methods are used. The teachers should have a thorough knowledge in the subject to conduct such

classes. The teacher brings a lot of specimens to the class and the students also are asked to bring specimens and to do experiments and assignments. The teacher should be able to clear all the doubts of students. The classes will be lively and there will be good teacher-pupil interaction. All students actively participate in the discussions and no one sits idle.

The activity-oriented method can be used in all science topics. Since very little research work has been done in teaching subjects other than science through activity-oriented methods, it could also be an area for further research.

- A survey can be conducted among teachers regarding their opinion about these methods. Such a study will be helpful in analyzing the expert opinion of teachers and also may give an insight into practical difficulties that the teachers could encounter in conducting such classes.
- The opinion of students and their parents can be collected through a survey.
- Further studies can also be conducted by dividing different types of activities to check which type of activity is best suited to increase the achievement and retention capacity of students belonging to different age groups.
- The attitude of teachers, students, parents and educators about bifurcating activity-oriented method can be collected and analyzed. It will be helpful in improving the method and organizing it according to the necessities of the students.
- A survey can be done to identify the schools in which some innovations are used to improve the teaching-learning process. The various innovations done and its effect can be studied.

Research is a process of making new discoveries, disproving old notions, establishing facts and improving current knowledge continually through tests and experiments which are repeatable and can be verified independently any time.

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