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Effectiveness of 5E and Lecture Model for the Teaching of Physics at Secondary Level

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Abstract

The current study was conducted to estimate the usefulness of 5E model and Lecture Model for the teaching of Physics at secondary level. It was an experimental study and true experimental design was used to conduct the research. The students of secondary level who were studying Physics in District Kotli were the population of the study. Two high schools; Government Boys Model Pilot High School Kotli and Government Girls High School No.1 were selected as sample frame schools. 44 students were selected randomly from each school. Pre-test was given one week before the treatment and on the basis of pre-test 22 students were placed in control group and 22 were placed in experimental group. Hence 88 (44 boys and 44 girls) were the sample of the study. Lecture model was used to instruct control group where as the students of experimental group were instructed through 5E model. After the treatment of eight weeks post-test was given and results were analyzed by using SPSS. It was found both models were effective but 5E model was more effective for the teaching of Physics at secondary level. It was recommended that the 5E model may be used instead of lecture model at secondary and higher secondary level.

Keywords: *Effectiveness, 5E Model, Lecture Model Academic Achievements, Treatment.*

Introduction

Education is a teaching learning process. Learning depends upon instruction. During instruction, a child cannot be treated like an empty vessel into which any type of information can be passed down. A teacher must think of ways and means of stimulating and encouraging learning in the students. Teacher should provoke their interest and motivate them to learn. He should create conditions in which they feel the need to learn. Many teachers use traditional methods of instruction in Pakistan. It may be difficult to motivate the students to learn a subject particularly to the students of a large class with traditional learning methods (Stes, Maeyer, Gijbels& Van Petegem, 2012).

Limited time is offered to the students of secondary school to cover their courses. Traditional methods of instructions do not allow the teachers to give special attention to every student, as a result the gap between pathetic and brilliant students have been considerably increased. This situation may be easily coped with the help of activity based approaches. Christensen (2004) narrated that guidance, management and emotional issues are the core areas to deal at secondary level (Hmelo-Silver, 2004).

Organizing activity-based learning is a good plan for different student groups. The member of the group may be dependent on another in order to attain the objectives of learning framed by their instructor. The students of specific group are responsible for the success and failure of each other. The members of the group help instructors and fellows to strengthen the overall performance of the group. This approach diminished the chances of objectionable circumstances and enhances the learning satisfaction which finally fabricates desired outcomes. Teachers may teach through much activity based teaching methods i.e. STAD, Jigsaw, group discussion and various E models for the teaching of natural sciences (Jamaludin & Mokhtar, 2018).

5E instructional model was introduced by the "Biological Science Curriculum Study (BSCS) under the supervision of Roger Bybee. This model explains a teaching chain consisting of five phase, each phase starts with word "E" i.e. Engagement, Exploration, explanation, elaboration and evaluation. Applying 5E model, teacher should relate students understanding of concept with daily life by giving and asking examples from real world. By active learning, students are able to make a relationship between their knowledge and real world. This makes science lessons more interesting. Many researchers conducted research on 5E model deliver that this model enhances the interest in researching, goes with the student's hopes, and includes active learning processes. Students play significant role in dynamic learning during the lesson which is taught to them by "5 E" models. Teachers need to get trained before their working (Bybee, 2009).

As explained above the instructional model has significant role in teaching learning process at any level of the study, therefore researcher carried out this research for the comparison of "5E" and "Lecture Model "for the teaching of Physics at secondary level.

Objectives

1. To explore the academic achievements of the students before and after the treatment.
2. To find out 5E Model's effectiveness for the teaching of Physics at secondary level.
3. To find out Lecture Model's effectiveness for the teaching of Physics at secondary level.
4. To compare the effectiveness of 5E model and Lecture Model for the teaching of Physics at secondary level.

Research Hypotheses

$H_0$1: There is no significance difference between the results of pre-test of control and experimental groups.
$H_0$2: There is no effectiveness of Lecture Model for the teaching of Physics at secondary level.
$H_0$3: There is no effectiveness of 5E Model for the teaching of Physics at secondary level.
$H_0$4: There is no significance difference between the results of post-test of control and experimental groups.
$H_0$5: There is no significance difference between the effectiveness of lecture model and 5E model for the teaching of Physics at secondary level

Literature Review

5E Model

In late 80s the "Biological Science Curriculum Study (BSCS), a team led by Principal Investigator Roger Bybee made an instructional model for constructivism, called the "Five Es". This model explains a teaching chain consisting of five phase, each phase starts with word "E" a brief description of each phase of "5E" Model is as given below;

Engagement

In this phase instructor engages the students by showing them a variety of AV aids or by asking various interesting questions. The instructor may ask the students to perform a short time activity to engage them and make them active and ready for the session. In this way teacher tries to hold the interest of students (Bybee, 2014).

Exploration

In this phase instructor provides time to students to work together to explore knowledge and new ideas. In this phase students interact with each other to share their views about certain topics and sub topics. During this phase teacher remains there in the class and keeps on moving within the class to keep an eye over the activities of the students (Tezer&Cumhur, 2017).

Explanation

In this phase instructor encourages students to enhance their knowledge and provides scientific explanations to erase misconceptions. This is the phase where the role of the teacher comes to the fore and he has to do real teaching. The teacher defines the topic and sub topics to the students (Chin, 2006).

Elaboration

In this phase, instructor delivers a deeper and detailed knowledge on the topic and sub topics. In this phase teachers elaborates the topics by showing various AV aids and by giving them details of the related subject matter. This phase includes different creative activities which make clear their misconceptions and flaws (Yang, 2009).

Evaluation

This is the last and vital phase of the 5E Model. In this phase instructor assesses students' knowledge and skills with the help of a SAT which he already prepared for the purpose of assessment. This test may be an activity or a written test that may help teachers to guess the level of understanding of the students (Shaheen &Kayani, 2015).

Outcomes of the 5E Model

There are many modifications of this study like 3E, 4E, 7E etc. The basic thing is that students are familiar with this learning method. The outcome of 5E Model could be;

- Getting more success in physics.
- Increase in memorization of concept.
- Better attitude of people towards physics learning.
- Improved behavior or teacher towards physics teaching.
- Better reasoning skills (Sickel, 2017).

Importance of 5E Model

Applying 5E model, teacher should relate students understanding of concept with daily life by giving and asking examples from real world. By active learning, students are able to make a relationship between their knowledge and real world. This makes science lessons more interesting. Many researchers conducted research on 5E model deliver that this model enhances the interest in researching, goes with the student's hopes, and includes active learning processes. Students play significant role in dynamic learning during the

lesson which is taught to them by "5 E" models. Teachers need to get trained before their working (Coburn, 2001).

Lecture Model

"Lecture" word of Latin language originated from Lectus, used in 14th century. Its meaning is "To read". But when this word use in Latin language it means "that which is read". In 16th century this word used for explanation that oral instruction given to learners with large audience by teacher teachers use different methods to deliver lecture to their learners. Some teachers use white boards, some use black boards and chalk. Lecture method does need those which are required for other methods that are why it is simplest method of teaching.

This method also called a one-sided method. For these reasons it is considered a poor way of teaching and students can't get more benefits of that. Here those reasons will be disused by which it has been used for a long time, and also those reasons for which it is cindered a poor way of learning and teaching. It was introduced by philosophers of idealism. It is considered as an oldest teaching technique. By methods we mean that procedure in which ideas can be clarified or explained in details. The main focus of this method is that to present contents to a large audience, in which teacher has to play active role but students play passive role. But keep them attentive in class, he ask questions time to time. In lecture method he uses expressions, gesture, and tones and also changes these things time to time (Anderson, 2003).

Lecture method is a method which has been used in past. It can be adopted anywhere and anytime. It is easiest and simplest method which is mostly used around the world, designed for large audience. That's why it is adopted by most of the institutions; hundreds of students can be taught in a very short time. A lot of information can be coned easily. There are advantages and disadvantages of lecture method which will be addressed in the following along with alternatives of the method. There are just as many disadvantages to the lecture method as there are advantages, with suggestions for teachers who face difficulties in lecture method (Miettinen, 2000).

Lecture instruction is done to cover a large data or information in a small time (Berry, 2008). In a research study Bok, 2006, states that after each lecture, only 42% of information remains in an average student's mind. Thus percentage drops to 20% after a week. According to some research study, lecture method is an ineffective technique for functional understanding of a topic (Wiebe Berry & Kim, 2008).

Materials and Methods

The nature of the study was experimental. Pre-test post-test equal group design was adopted to conduct the research. All (2178) students of secondary level who were studying physics in district kotli were the population of this study. Two sample frame schools selected purposively and then Random sampling technique used to select the sample from sample frame schools. 88 (44 from each school) students were selected randomly as the sample of the study. Objective type Subject Achievement Test (SAT) of 50 marks was used as an instrument.

The SAT was distributed one week before the start of experiment to all the students and scores were obtained. On the basis of the results of pre-test students having equal competencies were placed into two groups (Control and experimental). Control groups were treated with lecture model where as experimental groups were treated with 5E Model for eight weeks. After eight weeks same SAT (With changing order) was distributed to the students and scores were obtained. Data were quantitative in nature independent sample t-test and paired sample t-test was used to analyze the data.

Results

The representation and interpretation of the data is given below

Table 1: Academic achievements of experimental and control groups in Physics before the treatment

Group	N	Mean	SD
Experimental	44	21.64	2.966
Control	44	20.30	2.366

N=88

Academic achievements of students in Physics before the treatment were explored by using descriptive statistics. Table 1 shows that the students of both groups have achievements before the treatment, the results of experimental group were: N=44, M=21.64, SD=2.2966 and the results of control group were; N=44, M=2030, SD=2.366.

Table 2: Academic achievements of experimental and control groups in Physics after the treatment

Group	N	Mean	SD
Experimental	44	45.36	7.828
Control	44	39.14	5.005

N=88

Academic achievements of the students in Physics after the treatment were explored by using descriptive statistics. Table 2 shows that the students of both groups have achievements before the treatment, the results of experimental group were: N=44, M=45.36, SD=7.828 and the results of control group were; N=44, M=39.14, SD=5.005.

Table 3: Comparison between results of pre-test and post-test of control group

Control Group	Mean	N	SD	Df	T	p
Pre-test	20.30	44	3.366	43	-25.149	.000
Post-test	39.14	44	5.005			

N=88

Table 3 shows that there reveals that significance difference between the scores of pre-test and post-test of control group was existed . The scores of pre-test were; N= 44, M= 20.30, SD=3.366, and scores of post-test were; N=44, M= 39.14, SD= 5.005. t= (43) -25.149 and p=.0000<0.05

Table 4: Comparison between results of pre-test and post-test of Experimental group

Exp. Group	Mean	N	SD	Df	t	p
Pre-test	21.64	44	2.996	43	-20.33	.000
Post-test	45.36	44	7.828			

N=88

Table 4 shows that a significance difference between the scores of pre-test and post-test was existed . The scores of pre-test were; N= 44, M= 21.64, SD=2.996, and scores of post-test were; N=44, M= 45.36, SD= 7.828. t= (43) -20.33 and p=.0000<0.05

Table 5: Comparison between the results of pre-test for control and experimental group

Group	N	Mean	SD	Df	t	P
Control	44	20.30	3.366	86	1.983	.226
Experimental	44	21.64	2.966			

N=88

Table 5 indicates that no significance difference between the scores of pre-test of control group and experimental group was found. The scores of control group were; N= 44, M= 21.20, SD=2.278, and scores of control group were N=44, M= 20.30, SD= 3.366. t= (86) 1.983 and p=.226>0.05.

Table 6: Comparison between the results of post-test for control and experimental group

Group	N	Mean	SD	Df	t	P
Control	44	39.14	5.005	86	-4.446	.000
Experimental	44	45.36	7.828			

N=88

Table 6 shows significance difference between the scores of post test of control and experimental group was existed. The scores of control group were; N= 44, M= 39.14, SD=5.005, and scores of experimental group were N=44, M= 45.36, SD= 7.828. t= (86) -4.446 and p=.000<0.05

Discussions

In Azad Kashmir various models of instructions are in use for the teaching of natural sciences. However most of the teachers give preference to lecture model because it is very easy for them to prepare. This study was conducted to determine the usefulness of "5E" model for the teaching of Physics at secondary level.

First objective of the study was to explore the academic achievements of students in Physics before and after the treatment. The results revealed that the students have academic achievements in Physics at secondary level before and after the treatment through 5E Model and Lecture Model.

Second objective was to find out 5E Model's effectiveness for the teaching of Physics at secondary level. The results revealed that 5E Model was effective for the teaching of the Physics at secondary level. The results of the current study were similar to the study of an Irish researcher "Bincy, who conducted a research in 2010 in his native country and found that 5E model of instructions is very useful for the teaching of biology at secondary level.

Third objective was to find out the effectiveness of Lecture Model for the teaching of Physics at secondary level. The result showed that lecture model was also effective for the teaching of Physics. The results of current study were similar to the results of the study conducted by Roya Sadeghi and Muhammad Mehdi Sedaghat in (2014) in Tehran to find out the effect of Lecture and Blended teaching. They concluded that both models have significant effectiveness on the academic performance of the students in the subject of chemistry at secondary level.

And the fourth objective was to compare the effectiveness of 5E model and lecture model for the teaching of Physics at secondary level. The results of the study showed that 5E model is more effective for the teaching of Physics at secondary level. Arbab (2003) examined the effects of cooperative learning on general science Achievements' of 9th class students. He found that cooperative learning had more positive effect on student's general science achievement as compared to usual method of teaching general science.

Conclusions

1. It is concluded that students of both groups have academic achievements in Physics before and after the treatment.
2. It is concluded that "Lecture Model" is effective for the teaching of Physics at secondary level as average marks of post-test were more than average marks of pre-test of control group.
3. It is concluded that "5E Model" is effective for the teaching of Physics at secondary level as average marks of post-test were more than average marks of pre-test of Experimental group.
4. It is concluded that 5E model is more effective than lecture model for the teaching of Physics at secondary level.

Recommendations

Following were the recommendations of the study.

1. Current study observed only the a results of students in physics , looking at the importance of remaining compulsory subjects; it is recommended that additional studies may be carried out to investigate the effectiveness of traditional learning as well as 5E Model to examine the attitude towards subjects.
2. Results of this study showed that Lecture model is effective for the teaching of Physics at secondary level; therefore it is recommended that teachers may use lecture method for the teaching as it is very easy for them to prepare and deliver in the short time. Students are suggested to note key points in their note books.
3. This study showed that 5E Model is also effective for the teaching of Physics at secondary level, hence it is recommended that teachers may adopt 5E model in order to motivate the students to obtain good results as an activity based approaches motivate students and both students and teachers remain active throughout the session.
4. Results of the current study showed that 5E model is more effective for the teaching of Physics as compare to the Lecture Model, so it is strongly recommended that the application of 5E model may be encourage for the teaching of science subjects at secondary level and higher secondary level.
5. Looking at the effectiveness of 5E model, it might be included as integral part of teachers' training programs.

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