5E Instructional Model: Enhancing Students Academic Achievement in the Subject of General Science at Primary Level

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Abstract

There are different instructional models that teachers adopted for the teaching of students different subjects. Among all those a student centered model is 5Es instructional model. This model concentrates on the engaging students, made exploration through students, explains and elaborate the learning concepts by students and then to evaluate students learning. All these 5Es provide ample space for students' hands-on practices of the learning contents. This experimental study was conducted at primary level in the subject of General Sciences following pretest posttest equivalent group design. Two groups (control and experimental) were formed from 52 students of 5ht grade where both the groups were given same number students. The data were collected through the pretest and posttest and was analyzed through mean score, standard deviation and paired sample t test.The major findings of the study were that the overall academic achievements of experimental group taught with 5E instructional model enhanced significantly as compare to control group. The study also found significant increase indifferent aspects of cognitive domain of students' learning; knowledge, application, comprehension and skill development abilities of experimental group taught with 5E instructional model.

Key words: 5Es instructional model, academic Achievements, Constructivist approach

Introduction

The prime goal of 21st century education is to prepare students for contemporary world challenges. The rapid and diverse developments in science and technology that yielded even in the living standards ofcommunities have increased the expectations of people from contemporary education system.This demands the replacement of traditional methods ofteaching and the out-

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dated curriculumin the educational institutions and as a result changes occurs both in the instructional models and curriculum through research explorations and empirical studies. On one side of thesedevelopments changes in curriculum have been reflected while on the other hand a shift in the instructional methodologies has been recorded from teacher centered approaches to learner centered. The role of a teacher is active and role of student is passive in transmission of curriculum. While on the other hand in a transactional curriculum, the learners are actively involved in learning process (Gray, 1997).

Constructivist teaching approach promotes critical thinking and produce active and motivated learners. Zemelman, (2005) contends as the learning in each and everyarea under discussion involvesoriginationand construction of new ideas. It was also recommend that constructivist theory may be included as a part of the curriculum, and suggested that teachers may create such learning environments so that the learner can construct their own understandings.Constructive paradigms have been considered the major problem in current education system (Shaheen, 2015). In majority of the cases, the instructorsare unaware of the demands and challenges posed by twenty first century's for the individuals. That is why; their meeting point upon constructivist framework is the background in which learning occurs.This is how, an individual integrate the knowledge that was achieved in the past and present and this is how it construct exclusiveblueprints of understanding (Richardson, 2003).

The instructional model is based on nature of science that reflects investigation along with various methods by which children learn according to nature (Cavallo & Laubach, 2001). That is why emergence of various editions of the instructional models about scientific curricula with that have huge numbers of collections and over the time it rangesfrom 4E to 5E while the latest is 7E. Settlage (2000) is of the view that the diversity in amount of phases are of no relevance as the goal is same.

Presently, the countries are focused towards scientific education, therefore Pakistan being a developing country, needs curriculum based on scientific education so as to meet to the standards of developed countries.It is important to focus on teaching and learning from secondary to higher secondary level, there is need that curriculum must be knowledge based that should reflect scientific aptitude in learner (Zareen, & Kayani, 2014).

In 2006 Pakistan has reviewed its curriculum based on bringing uniformity about it in country consisting of format, objectives, criteria and learning outcomes. It was done to focus upon primacy of students' experiences, their voices and involvement in learning.Science knowledge is significant for students' comprehension and teaching methodology is really a vital factor for transmitting knowledge and content to students at the primary level. Today, science has become an essential part of our life and living. According to Cornelius Bernardus Van Niel (1897-1985) "In life, science is a continuous search for a cognitive and integrated understanding of the world we living in". Similarly the author further added that "science is the work of truth".

The goal of science teacher is to encourage students by engaging and supervising them for learning through experiences. This can be possible through different instructional models. These instructional models have different phases but the dissimilarity in quantity of phases does not make any difference as the goal is the same (Settlage, 2000). This study used 5E instructional model for enhancing student's academic achievement in general science which is most helpful in dynamic learning of childrenas compared to lecture method of instruction in cognitive development, 5Es teaching approach is better for students understanding" (Schneider & Renner, 1980). Furthermore, the 5Es learning cycle which basically an instructional design model, illustrates a learning sequence that reflects John Dewey experiential learning philosophy together with David Kolb's experiential learning cycle (Kolb, 2012).

Bybee, (2015) presented anoutline for constructivist learning theories that can be effectively utilized in teaching science. He actually describes 5Es model into following five phases such as: 1) Engaging, 2) Exploring, 3) Explaining, 4) Elaborating and 5) Evaluating. In 5Es instructional model the first (E) means students engagement in the learning tasks while a teacher plays the role of facilitator. Science teacher at the primary level helps students to recall and clarify their previous understanding through short activities and tries to bring up them with new concepts and modern ideas. At the primary level teacher try to- Engage students, Ask General questions, Brainstorming. The second phase of 5Es model is exploration. The students are given space or freedom to explore their ideas. Exploration gives a direction to a later introduced lesson and familiar students with the concepts, process and skills. At this stage students do: Investigation, Collecting information's, construct a model.

The third phase of 5Es instructional model is explanation, students at this phase arises to place the intellectual practices and science teacher clarify the misconception of the students, adapt vocabulary for their understanding, improve skills and provide further learning experiences. At this stage of explanation there are: Reading and discussion, Explanation and analysis, Ideas with related proof and questioning.

The fourth phase of 5Es model is elaboration. The students at this stage ensure an opportunity to express their thoughts through practicing it practically in the classroom environment that improve their knowledge, skills and reasoning power. They go for finding evidence, experimental inquiry, collecting data, solving a problem and making decision.

The last phase of 5Es model is evaluation and the comprehensive investigative process. In this stage the evaluation is done through writing assignments, exams, peer-evaluation and self-evaluation etc. Student focuses on their own progress, tries to identify their weaknesses and further work on them. Tools used for evaluation such as: Rubric or other tool for scoring, Performance assessment and Portfolios.

We can conclude that this model is based on student's logical and critical thinking. 5Es is a model used for instructional activities that helps students to be properly involved and actively engaged in the learning. On the basis of the constructivist approach, the 5Es instructional model is used in the collection of actions that raises the concerns of students, helps the students potentials connected with the lesson as well as covers dynamic procedure of their abilities and understanding. The current study examines science student's success as a result of 5Es instructional model at the primary level.

Methodology

The researcher used pre-test post-test equivalent group design from the experimental research design which ensures the valid results and reduces the changes of errors. The researcher conducted pre-test in order to equally divide the students in two groups. After pre-test the researcher divided a group of fifty two (52) students into two (2) equivalent groups, each group contain twenty six (26) students on basis of their pre-test scores. One groupknown as experimental group was treated on 5Es instructional model while another group was treated on traditional lecture method called control group. The treatment time for the intervention was six weeks. Both the groups were taught for six weeks in the selected instructional approaches (5Es

instructional model and Lecture method) without any interruptions and were post-tested for the purpose to measure the effects of the experimental instructional model on the academic achievement of students in the selected subject (General Sciences).

R "e"	=	T	O_1
R "c"	=	-	O_2
Difference =		O_1	$– O_2$

Before the data collection on pre-test and post-test the developed achievement test was pilot tested to measure the reliability of the test following Cronbach alpha method. The pilot testing was made on 30 students of grade 5^{th} in Government Primary School in district Swat and the collected data were placed into SPSS for reliability test. The reliability co-efficient was($\alpha = 0.73$) which was an appropriate level as suggested by Hussain (2017).The collected data were analyzed through SPSS 21 following mean standard deviation and paired sample tests.

Results

Table 1: Students' performances of Experimental and control groups on pre-test

Parameters of learning	Group	N	Means	S.D	t	P
Academic achievement	Exp	26	19.96	3.05	0.39	0.613
	Con	26	20.61	3.17		
Knowledge ability	Exp	26	3.40	2.35	0.22	0.819
	Con	26	3.53	2.21		
Application ability	Exp	26	2.26	1.53	0.61	0.376
	Con	26	2.17	1.38		
Comprehension ability	Exp	26	4.65	2.94	0.73	0.472
	Con	26	4.08	2.53		
Skill development ability	Exp	26	4.59	1.73	0.99	0.347
	Con	26	4.52	1.21		

Critical value of t at 0.05 =1.96 df=50

Table 1 reflects the performances of experimental group in means (M =19.96) which are near to the mean score of control group (20.61) and the p-value (0.613) revealed the insignificant differences between the two groups. Similarly, the mean score of experimental group (3.40) on

knowledge ability of respondents were also near to the results of control group which was 3.53 the p-value (0.819)showed that students of experimental group were significant not different from control students on this domain of learning on pre-test.

Likewise, the mean score of experimental (M =2.26) and control (M = 2.17) groups are approximately equal on application ability and the p-value (0.376) revealed the insignificant differences between the two groups. Similarly, the mean score of experimental (M= 4.65) and control (M = 4.08) groups are approximately equal on comprehension ability; the p-value (0.472) showed significant differences on comprehension ability between the students of two groups.

Likewise, the mean score of experimental (M 4.59) and control (M = 4.52) groups were found similar on skill development as reflected by the p-value (0.347)which showed no differences between the two groups on skill development ability.

Table 2: Students' performances of Experimental and control groups on post-test

Parameters of learning	Group	N	Means	S.D	t. values	P
Academic achievement	Exp	26	68.77	5.22	20.77	0.000
	Con	26	45.92	5.94		
Knowledge ability	Exp	26	13.53	1.93	11.37	0.000
	Con	26	7.22	2.42		
Application ability	Exp	26	15.76	2.20	13.41	0.000
	Con	26	9.01	2.49		
Comprehension ability	Exp	26	17.02	3.24	15.98	0.000
	Con	26	10.87	2.10		
Skill development ability	Exp	26	18.86	2.76	17.65	0.000
	Con	26	10.81	2.96		

Critical value of t at 0.05 =1.96 df= 50

Table 2 illustrated the mean scores of experimental group (68.77) is significantly high than control group (45.92) on post-test. The p value 0.00 evident the significant performances of experimental group students as compared to the students of control group. The results proved

that the overall academic achievements of experimental group taught with 5E instructional model enhanced students' performance significantly.

The result showed the performances of experimental group students (M =13.53) which is significantly higher than the students of control group students (M = 7.22) on knowledge ability, the calculated p= 0.000 showed that these differences between the groups are significant on knowledge ability and reflected the higher performance of experimental groups students.

Likewise, the mean score of experimental group students (M =15.76) is significantly higher than the students of control group (M = 9.01.88) on application ability and these differences between the two groups are significant as shown by the p= 0.000. This showed that the application ability of experimental group taught with 5E instructional model enhanced significantly.

Similarly, the mean score of experimental group students (M =17.02) is significantly higher than the students of control group (M = 10.88) on comprehension ability, this shows that there is a significant difference (p= 0.000) between control and experimental groups in their achievement level on comprehension ability. This shows that the comprehension ability of experimental group taught with 5E instructional model enhanced significantly.

The result shows that the mean score of experimental (M =18.86) is significantly high than control (M = 10.81) group on skill development ability, this shows that there is a significant difference (p= 0.000) between control and experimental groups in their achievement level on skill development ability. This shows that the skill development ability of experimental group taught with 5E instructional model enhanced significantly.

Discussion

The purpose of this work was to enhance student's academic performance through 5Es instructional model at the primary level. The major findings of the current study shows that the overall academic achievements of experimental group taught with 5E instructional model enhanced significantly as compare to control group taught with lecture method.

The result obtained through this experimental study confirmed the results of previous experimental studies conducted on 5E instructional model. A study by Sen, andOskay (2017) found 5E inquiry learning methods effective for improvement of achievement as compared to lecture-based method.The result of this study was also confirmed by Ranjan(2018), Shaheen(2015), Abidi (2014), Hussain (2013),Sarı, (2017) Hussain (2011),Siwawetkul (2018)

findings reveals that learners who were given instructions by using inquiry-based learning got higher score than those who were given instructions by using traditional method.

From the findings of the study, it was concluded that constructivist approach is better and more effective in science than the traditional approach. It is basically a theory or approach that concentrates on observation of data and then scientific study about how individuals learn and create new ideas. Therefore, the discussion in this paper has been made in accordance with above mentioned themes with focus on the concept of constructivist learning, 5E approach of constructivism, difference between constructivist learning and traditional loom of learning, teacher's and learners role in learning approach by constructivists, and repercussions of constructivist learning approach (Khalid, & Azeem, 2012). The constructivist approach focus on knowledge building rather than reproduction, it helps the learners to develop skill and attitude. Human knowledge is constructed; the learners builds upon their new knowledge on the groundwork of previous learning (Sarikaya, Guven, Goksu, & Aka, 2010). Two groups were taken: the experimental and the control group. The members of experiment group were taught by the investigator by using constructivist approach while control group members were taught through regular teacher who used their regular method of teaching. The study show that teaching through the 5E approach of constructivism is effective in enhancing achievement in mathematics of upper primary level as compared to traditional method. The diversity in types of practical examples and real life example, innovative activities made the constructivist approach more effective and interesting.

Recommendations

Based on this study it was recommended that modern and practical instructional techniques using constructivist approaches would enhance the need to improve students' learning at the elementary schools. It is also recommended that all those who are involved in planning science curriculum, organizing textbooks and teachers should have orientation about the importance of 5E instructional model in science education. Furthermore, the relevant authorities at the Ministry of National Education should plan toorganize teachers' seminars and training workshops on 5E instructional model; this will provide an opportunity to the teachers to advance their skills. Similarly, the authorities at school level are advised to encourage and influence their teachers to attend these programs.

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