Effectiveness of Five E Model on Attitude Towards Science

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Abstract

Present study was done to study the effectiveness of 5 E Model on attitude towards science of ninth grade students studying in two government and two private schools of Bari subdivision of Dholpur District, Rajasthan. The method employed for the study was experimental with two groups randomized matched subjects pre test post test design. The study was done on 154 ninth grade students. Result of the study indicated that the instructions based on 5 E model improved the students' mean scores on attitude towards science scale (ATSS). In light of these findings investigator supports the use of 5 E Model in science classrooms to get good results for better understanding of scientific concepts.

Keywords: 5 E Model, Attitude Towards Science

Introduction

Today more and more students are alienating themselves from pursuing basic science. The reasons attributed by students are like they find the subject boring, difficult and generally unnecessary for non-science-oriented careers. Many researchers feel that this difficulty stems from the passive role the students play in a traditional class (Zoller,2000). If this is the case, then there is need to modify the way of teaching in order to develop students who are enthused about science and who really understand the material. The researcher in this study attempts to design a better instructional approach of teaching science using an interactive and student centered approach (5E model) of instruction. The 5E Model is the most effective way of engaging students in learning. 5 E model leads students through five phases of learning that are described using words that begin with the letter E: Engage, Explore, Explain, Elaborate, and Evaluate. First it is provided that students are engaged in the concepts through a short activity or relevant discussion. Next, students explore the concepts with the others by developing a common set of experiences. In the Explain, the teacher guides the students to develop an explanation for the concepts they have been exploring. In the Elaborate, the students extend their understanding or apply what they have learned in a new setting. In the Evaluate, the students and the teacher have an opportunity to evaluate the students' understanding of the concepts. The purpose of the present study was to investigate the effect of the 5E learning model on ninth grade students' attitudes toward science. The activities were prepared and applied to enable students to understand the lesson easily, have fun and determine their own abilities. Before the treatment a science attitude scale were administered. After the application of pre-tests, the instruction based on 5E model was applied and after the treatment the measuring instruments were administered once more.

Review of Literature

Literature review revealed a number of studies that shows that 5 E learning cycle model promote the attitudes of the students of different disciplines, provide their conceptual development, and alter their attitudes in a positive way (Lord, 1999; McCormick, 2000; Stamp and O'Brien, 2005; Garcia, 2005). Boddy, Watson and Aubusson (2003) in their study concluded that primary school 3rd grade students found a unit interesting and funny that was taught by 5E Model. Findings obtained from student interviews have illustrated that using 5E Model motivates students to think and learn. Newby (2004) made applications based on 5E Model at the level of primary schools and he reported that student success increased when students felt more comfortable and experimental activities were integrated into the lessons. In the present paper the investigator attempt to find out whether 5 E Model has effect on students'attitude towards science. Hokkanen (2011) in her study ascertained that the implementation of the

5E learning cycle model in lesson planning and lesson presentation improved student academics, interest and confidence in science. The findings of these studies suggest that the 5E Instructional Model is effective than alternative teaching methods in helping students reach important learning outcomes in science. Bhardwaj (2013) in her pilot study ascertained that using 5 E Model in science classroom improves the attitude towards science of secondary level students. Abdi (2014) who also investigated the effectiveness of 5E learning cycle inquiry model on the science achievement among Year 5 students in Iran using similar analysis procedure. Equally, the finding of this study parallels the findings of Hokkanen (2011), with different age groups. Cakır (2017) carried out a meta analytical study to evaluate the effect of the 5E learning model on academic achievement, retention and scientific process skills. Data obtained from the articles and theses (2006-2016) was analyzed and the effect of the method applied for each dependent variable was found to favor the experimental group. Ong and Tajudin (2018) in their study also established a positive effect of 5 E Model on science achievement among Malaysian Year 5 Indian students.

Objectives of the Study

The present study purports to fulfill following objectives **–**

1. To study the effectiveness of 5 E model on attitude towards science of students of ninth class.
2. To study the effectiveness of 5 E model on different areas of attitude towards science of students of ninth class.

Major Hypothesis of the Study

Following hypothesis were tested in the present study –

1. There is no significant difference between the mean scores on attitude towards science scale of students of control and experimental group.
2. There is no significant difference between the mean of scores on different areas of attitude towards science of students of control and experimental group.

Materials and Method of the study

Present study employed experimental method with two groups randomized matched subjects, pre test post test design to test the effects of 5 E model on students' attitudes toward science of the unit named "Matter in our surroundings","The Laws of Motion" and "Fundamental unit of life" included in IX grades science and technology course. The symbolic view of the experimental pattern is shown in table 1.

Table 1: Two Groups, randomized matched subjects, pre test post test design of the study

Randomly assigned groups after matching	Pre Test	Independent Variable	Post Test
Experimental	Self made Attitude Test	Teaching by Investigator through 5 E model	Self made Attitude Test
Control	Self made Attitude Test	Teaching by Investigator through Conventional method	Self made Attitude Test

Variables of the Study

Variables studied in the present study are shown in table 2.

Table 2: Variables Studied

S.No.	Type of Variable		Name of Variable
1	Independent Variable		5 E Model of Instruction Traditional Teaching Method
2	Dependent Variable		Attitude towards Science
3	Intervening Variables	3.1 Controlled Variable	Grade Age Socio economic status Intelligence Duration of instruction Teacher Content
		3.2 Moderate Variable	Sex

Sample

For this study very large sample size is not feasible. Therefore small sample of 154 students from four senior secondary schools of Bari subdivision of Dholpur District was selected randomly for the present study. Sample size is shown in table 3

Table 3: Sample of the Study

S.N.	Name of School	No. of Students
1	Govt. Senior Secondary School, Kanchanpur, Bari, Dholpur	40
2	Brajesh Academy Senior Secondary School, Bari	38
3	Govt. Girls Senior Secondary School, Bari, Dholpur	40
4	Laxmi Shiksha Niketan Senior Secondary School, Bari, Dholpur	36
TOTAL 154		

Data gathering tools

For the present study following tools were used.

1 Socio Economic Status Scale SESS (R.L. Bhardwaj2006)
2 The Standard Progressive Matrices SPM set A, B, C, D and E prepared by J.C. Ravens (1958).
3 Self made tool of Attitude towards Science (TATS) -

S Tool of Attitude towards Science

The research studies on attitudes towards science, reveals that attitudes do not consist of a single unitary construct, but rather consist of a large number of sub-constructs all of which contribute in varying proportions towards an individual's attitudes towards science. In present study attitude towards science was measured with the help of Tool of Attitude towards Science (TATS) developed and standardized by the investigatosr. The tool was prepared in hindi following the Likert's method. The items in this tool covered six aspects of attitude viz. Self confidence in learning science, value of science, enjoyment in science learning, attitude towards scientific inquiry, anxiety towards learning science and motivation in learning science. The items indicate various degrees of favorableness towards science. The finalized form of tool consists of 30 statements with the adequate representation of the above mentioned dimension. Out of 30 statements 15 were of negative polarity and 15 were of positive polarity. This tool is suitable for group administration and as there is no time limit but on an average this tool can be administered within the duration of a normal class lesson of 25-35 minutes.

Reliability of tool of Attitude towards Science

In the present study the reliability coefficient of the tool was calculated using the split-half method. Since our tool has six domains reliability is calculated for each domain separately details of which are provided in table 4. From the table we can say that the tool has quiet high overall reliability and all the six domains of the tool are also reliable.

Table 4: Spearman Brown Reliability Coefficients for TATS and its domains

S.No.	Domain of tool	Reliability Coefficient
1	Self confidence in learning science	0.742
2	Value of science	0.69
3	Enjoyment	0.626
4	Anxiety	0.59
5	Attitude towards scientific inquiry	0.687
6	Motivation towards Science learning	0.774
7	Overall Attitude in Science	0.711

Validity of Tool of Attitude towards Science

The validity of a tool is the accuracy with which a tool measures what it purports to measure. Evidence regarding the validity of the attitude tool prepared lies in the procedure adopted for developing the test. TATS was developed very carefully following the principles of attitude scale construction. Details regarding the preparation of TATS is given in figure 1.

Figure 1 Procedure preparation of Tool of Attitude towards Science

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┌─────────────────────────────────────────────────┐
│   ┌─────────────────────────────────────────┐    │
│   │  1 Discussion with Experts, literature   │    │
│   │     review                               │    │
│   └─────────────────────────────────────────┘    │
│                      │                            │
│   ┌─────────────────────────────────────────┐    │
│   │  2 Initial pool of 60 Likert type        │    │
│   │     Statements                           │    │
│   └─────────────────────────────────────────┘    │
│                      │                            │
│   ┌─────────────────────────────────────────┐    │
│   │  3 Sent to number of Experts in          │    │
│   │    Education for their Suggestions       │    │
│   └─────────────────────────────────────────┘    │
│                      │                            │
│        ┌──────────────────────────┐               │
│        │  4 First Draft of        │               │
│        │    TATS having 36        │               │
│        │    Statements            │               │
│        └──────────────────────────┘               │
│                      │                            │
│   ┌─────────────────────────────────────────┐    │
│   │  5 Try out by administering first draft  │    │
│   │    to a sample of 180 students           │    │
│   └─────────────────────────────────────────┘    │
│                      │                            │
│   ┌─────────────────────────────────────────┐    │
│   │  6 Item Analysis by forming upper and    │    │
│   │    lower 27% criterion group             │    │
│   └─────────────────────────────────────────┘    │
│                      │                            │
│        ┌──────────────────────────┐               │
│        │  7 Final form of         │               │
│        │    TATS having 30        │               │
│        │    statements            │               │
│        └──────────────────────────┘               │
└─────────────────────────────────────────────────┘
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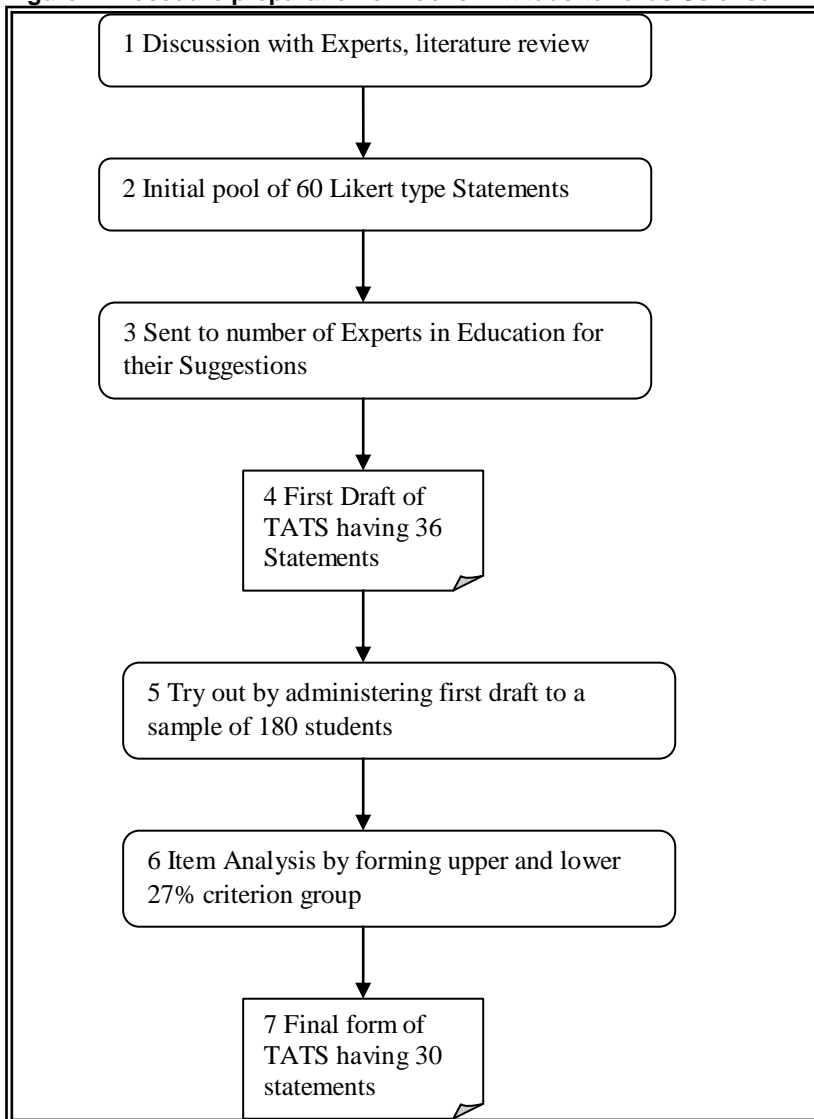
Data Collection

The data was collected by the investigator herself. For the data collection prior permission was taken from the principals of the schools selected in the sample. Firstly the students were divided in to control and experimental group after matching them for intelligence and socioeconomic status. According to time schedule the four month programme was given to the experimental group and control group. The experimental group was taught through 5 E model and the control group was taught through conventional method. Both the group was taught by investigator. Prior to experiment and after the experiment the TATS was given to students and from that data was collected to test the hypotheses.

Data Analysis

The inferential statistical analysis was conducted to test the hypotheses. For this mean, standard deviation, standard error of mean, t-value, F value, analysis of variance and its significance was calculated. And from the result of t-value the hypothesis were rejected or not rejected based on the level of significance (Garrett, 2008).

Analysis and Interpretation of Data

To analyze the significance of difference between the mean scores of control and experimental group, following hypothesis was stated, 'There is no significant difference between the mean scores on attitude towards science scale of students of control and experimental group." To test this hypothesis the mean, standard deviation, standard error of mean, t-value and its significance was calculated (Table 5).

Table 5: Mean, standard deviation, standard error of mean, t-value and its significance for experimental and Control Group

S.N.	Groups Compared		Mean Difference	SD	SE$_D$	t Value
1	Pretest Control	Pretest Exp.	3.45	27.38	6.12	0.56
2	Pretest Exp.	Posttest Exp.	31.73	27.38	6.12	5.18**
3	Posttest Control	Posttest Exp.	26.08	27.38	6.12	4.26**
4	Pretest Control	Posttest Control	2.2	27.38	6.12	0.35

** Significant at 0.01 level of Significance

From table 5 it can be interpreted that the obtained t-value 4.26 is greater than the tabular value at 0.01 level of significance. Thus there was significant difference between the mean score on TATS of experimental group and control group which was in favour of experimental group. Thus the hypothesis was rejected at 0.01 level of significance. Hence it could be concluded that experimental group have higher level of attitude towards science as compared to students of control group and 5 E model is effective than traditional method in increasing the attitude towards science.

Table 6 provides the analyses for the effect of 5 E Model on different areas of attitude towards science. The observed values of t for control group and experimental group for self confidence in learning science is 4.14 which is much higher than the tabular value at 0.01 level of significance at 152 degrees of freedom, hence students of experimental group are more confident in learning science. For the area of Value of science the t value came out to be 3.5 which

is higher than the tabular value at 0.01 level of significance at 152 degrees of freedom, hence the students of experimental group perceive high value of science for their life. The t value is found to be 3.79 for enjoyment area of attitude which is also significant at 0.01 level of significance hence the students of experimental group have more enjoyment in learning science. For the anxiety area the t value is found to be 4.09 which is higher than the tabular value at 0.01 level of significance at 152 degrees of freedom, hence the students of control group are more anxious of learning science. The t value for attitude towards scientific inquiry and motivation towards learning science is 4.603 and 3.55 respectively both are higher than the tabular value at 0.01 level of significance at 152 degrees of freedom, hence the students of experimental group are motivated towards learning science and scientific inquiry.

Hence it is concluded that 5 E model more effective than conventional method in enhancing the attitude towards science.

Table 6: t Values for different areas of attitude tools for analyzing the significance of difference between control and experimental group.

Areas Of Attitude	Group	N	MEAN	S.D.	SE$_D$	t Value
Self Confidence in Learning Science	Control	77	4.28	2.06	0.871	4.14**
	Experimental	77	7.89	1.75		
Value of Science	Control	77	8.03	1.45	1.40	3.5**
	Experimental	77	12.93	3.12		
Enjoyment	Control	77	5.62	2.97	2.30	3.79**
	Experimental	77	14.34	3.24		
Anxiety	Control	77	11.68	2.65	1.53	4.09**
	Experimental	77	75.23	1.73		
Attitude towards scientific inquiry	Control	77	3.88	1.91	0.706	4.603**
	Experimental	77	7.13	1.6		
Motivation towards Science Learning	Control	77	8.58	1.97	1.33	3.55**
	Experimental	77	13.3	2.79		

Conclusions and Discussion

From the results of present study it is indicated that 5 E model is more effective than traditional teaching method. The findings are in line with the studies mentioned earlier in this paper. Since this method improves student attitude towards science therefore it is recommended that science teachers must use this model in classrooms for better learning environment. It is the high time to change our

lesson plan formats to constructivist one for pre service teachers so that they can achieve success as a teacher.

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