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Differential Effects of Experiential Learning Intervention and Traditional Class-Room Approach on Scientific Attitude of Secondary School Students

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Abstract

The study aims to determine the differential effects of experiential learning intervention and traditional class-room approach on scientific attitude of secondary school students. A multistage random sampling technique was opted and sample consisted of 90 students from class IX. The students were divided into experimental group (45) and control group (45) on the basis of scores obtained by them in science subject of previous VIII class. An experimental group was taught through experiential learning intervention programme and the control group was taught with a traditional class-room approach. Pre-test and post-test were administered on experimental group and control group. Standardized scientific attitude scale by Bajwa & Mahajan (2009) was used for data collection. Data was analyzed by employing independent sample't' test and paired sample't' test. It was concluded that experiential learning programme had a significant effect on scientific attitude of secondary school students as compared to traditional classroom approach. The research has its applications for in-service teachers, policy makers, Department of School Education and Literacy, Ministry of Human Resource Development, school administrators, apex bodies of school education and students of secondary schools.

Keywords: Experiential Learning Intervention, Traditional Class-Room Approach, Scientific Attitude

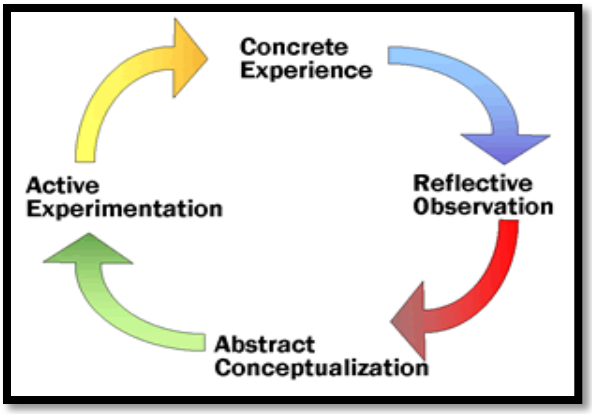
Introduction

The notion of learning by experience is as old as human civilization. Aristotle in *The Nichomachean* (Ross & Brown, 2009) stated that "for the things we have to learn before we can do them, we learn by doing them". The process of learning is due to experiences and every individual learn in a different way (Yoon, 2000; Kolb, 1984). The learner creates new knowledge of understanding while engaging in innovative activities. A teacher similarly occupies the role of a facilitator. Besides providing certain guidance he/she motivates the learner towards some experiential activities. Thus a student/learner is at the centre and teacher's role is to develop method for engaging students for new experiences. It provides him access to knowledge and practice in particular skill and disposition. The technique in which students are encouraged to be trained, the idea of thought material by experiment and creating the goal of construction of knowledge, and, skill from direct experiences are termed as experiential learning. Experiential learning is a process by which students "learn by doing" and through which a student develops knowledge, skills and values from direct experiences. Various terms have been used to label the process of learning from experiences. Experiential learning theory emerged as a result of taking students' individual differences into consideration. Dewey takes experiences as a basis of learning, Lewin highlights the importance of students' being active in the learning process and Piaget recognizes intelligence as a conclusion of the interaction between the individuals and their environments as well (Yoon, 2000; Kolb, 1984). Montessori emphasizes child's motivation to learn in new learning environment and working with the given material at regular intervals (Smith and Knapp 2011).

Experiential learning above all is an effective way of learning. Science is involved in almost all spheres of human life and living and our society is entirely drawn into the scientific surroundings. Experiential

learning theory defines 'learning' as a process consisting of four steps. According to Kolb (1984) students should experience four phases of learning. Experiential learning cycle should be structured from concrete experiencing to observation and then from abstract conceptualization to active experimentation. Concrete experiences are turned into abstract concepts within this process and these concepts are used in attaining new experiences. Kolb's model of experiential learning is shown in Figure 1

Fig-1 Kolb's Model of Experiential Learning



Scientific Attitude

Science has illuminated the human innovative potential. It is included in school curriculum like other subject. It inculcates certain special values such as rational, artistic, ethical, aesthetic, innovative, disciplinary, functional and occupational. Science learning further plays an important role in providing training in scientific methods and scientific attitudes. Learning science can develop some faculties of mind through logical reasoning and conducting experiments. According to Grinnell (1992), the scientific attitude is an organized description of the cognitive and societal description of science. Scientific attitude is the most important outcome of science teaching. It is a form of open mindedness, a desire for accurate knowledge, assurance in events for seeking information and belief that the answer of problematic question will come through the use of confirmed knowledge. The development of scientific attitude among students should always be considered by teachers. Without a questioning mind and a will for investigation, scientific attitude among learners can't be developed. Rao (1989) gave some elements of scientific attitudes i.e. open-mindedness, critical-mindedness, respect for evidence, suspended judgment, intellectual honesty, willingness to change opinion, search for truth, curiosity and rational thinking.

Scientific attitude is a collection of a number of mental habits or of tendencies to react consistently in certain ways to a novel or problematic situation. These habits are important in the everyday life and thinking. These habits or tendencies further make the learner capable of looking for true cause and effect relationships—a cognitive concept associated with the mental processes of scientists. Scientific attitudes possess attributive thought to be either true or false and do not express an evaluative quality. To reduce the semantic confusion, scientific attitudes may be better labelled as "scientific attributes" (Bajwa and Mahajan, 2009). The attributes of a scientific attitude are:

Rationality

It refers to quality or state of being reasonable and logical based on facts and reasons. It implies the consistency of one's beliefs with one's reasons to believe or of one's actions and reasons for action.

Curiosity

It refers the inquisitive thinking such as exploration, investigation, and learning by observation.

Open-mindedness

This is the way in which people come up to the views and knowledge of others, and integrate the viewpoint that others should be free to convey their views and that the value of others' knowledge should be established

Aversion to Superstitions

It refers to disliking of a belief or opinion not based on rationale or facts.

Objectivity and Intellectual Honesty

It is an applied method of problem solving, characterized by an unbiased, honest attitude.

Suspended Judgment

It refers to a cognitive process and a logical state of mind in which one withholds judgments, in drawing of moral or ethical conclusions.

As a whole the scientific attitude include a person's belief to deal with mental behaviour or a problematic situation, open mindedness, finding out the cause and effect relationship, critical judgment or evaluation, intellectual honesty, creativity, flexibility and originality.

Science courses are generally subject oriented and require experiments and demonstrations. Every year science subject is loaded with more content and teachers have to complete that content in their classrooms with the little time awarded to complete those courses. Though, India is believed to be the second largest science studying nation but as far as innovations, researches and Nobel prizes in science and technology are concerned, the country lags behind. Keeping in view, the need of the science learning the researcher has opted for the present study.

Review of Literature

Tasdemir, Kartal and Kus (2012) investigated that out-of-the-school learning environments is helpful for the formation of scientific attitudes in teacher training programmes. It was found that out-of-the-school learning environments have a positive influence in students' attitudes towards science.

Khan and Khan (2012) investigated the development of scientific attitudes in secondary school biology teaching. The inquiry method of teaching in Biology was adopted for the development of scientific attitude of the students. Statistical analysis of the data showed that inquiry method is more effective for the developing the scientific

attitudes as compared to traditional method of teaching.

Sener, Turk and Tas (2015) conducted research to observe the effects of a science education project on secondary school students' creative thinking and their attitudes toward science lessons. The results of the study showed that the project was helpful in enhancing the students' attitudes towards science subject and their levels of creative thinking.

Abed (2016) studied the effect of drama-based science teaching on students' understanding of scientific concepts and their attitudes towards science learning. It was evident from the study that drama based science teaching are able to understand the scientific concept and have positive scientific attitude towards science learning.

Balaji (2017) observed the role of science teacher in developing scientific attitude among secondary school students. The study revealed that science teacher plays an important role in developing scientific attitude among students by organizing field trips.

Objective of the study

To study the effect of experiential learning programme on scientific attitude of secondary school students.

Hypotheses of the study

Experiential learning programme will have significant positive effect on scientific attitude among secondary school students

Methodology

This research is experimental in nature and aims to analyze the differential effects of experiential learning intervention and traditional class-room approach on scientific attitude of students. The multistage random sampling technique was used and sample consisted of 90 students from class IX from Kanya Gurukul Senior Secondary School, BPS Mahila Vishwavidyalaya, Khanpur Kalan. The study was completed in four phases. Each phase is described as follows:

Phase –I

Selection of sample for the Study

A total of 90 students comprising high, average, and low achievers in science of class IX were selected based upon their scores /grades of their previous class. Thereafter, the sample of the study was divided equally into experimental and control groups.

Phase –II

Pre- Testing Phase

At this stage Scientific Attitude Scale by Bajwa and Mahajan, 2009 was administered on the sample.

Phase –III

Execution of intervention programme /experiential learning programme

In this phase, the experimental group was exposed to sixty days experiential learning programme designed by the investigator. The lesson plan for experiential learning programme was prepared for each day. The investigator herself taught the classes of control group in traditional settings by chalk and talk method. The experiential learning programme was based on Kolb's Model of experiential learning involving four stage steps as given in figure-1. The package of experiential learning programme included learning through examples, observations, brainstorming, projects model building, laboratory activities, simulations, asking learners to use real problems, discussions, homework assignments, animation/ video clips, cooperative learning, student debates class game, learning by teaching etc.

Phase –IV

Post-Testing Phase

In this phase, the experimental and control group were again tested through Scientific Attitude Scale to see the effect of experiential learning intervention programme on scientific attitude by computing pre-test and post-test scores.

Data was analyzed by employing independent sample 't' test for mean difference between the groups and paired sample 't' test was used for calculating mean difference within the groups.

Result and Discussion

Difference between the Experimental and Control Group Mean Scores for Scientific Attitude

In post-testing phase the difference between scientific attitude of experimental and control group was explored. This was done by testing the significance of difference between the means of post-test scores of two groups on their scientific attitude. The means and standard deviation of the post-test scores of two groups, were computed along with the 't' value and it is presented in Table 1

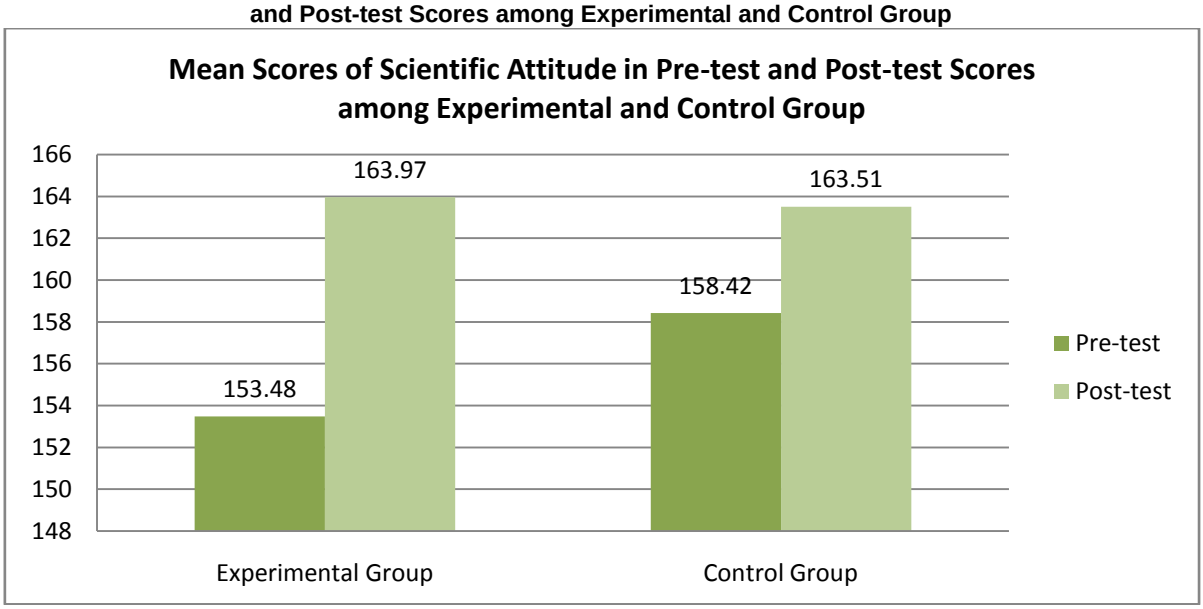
Table-1: Significance of Difference between the Mean Scientific Attitude Pre-test and Post- test Scores of Experimental and Control Group

Variable	Group	Test	N	Mean	Gain (Post-pre)	SD	't' value	Result
Scientific Attitude	Experimental Group	Pre-test	45	153.48	10.49	10.54	6.41	Significant at 0.01 level
		Post-test	45	163.97		11.59		
	Control Group	Pre-test	45	158.42	5.09	14.72	2.75	Significant at 0.01 level
		Post-test	45	163.51		13.12		

It was revealed from table-1 that scores of pre-test come out to be in 153.48 in experimental group and 158.42 in control group with standard deviation 10.54 and 14.72 respectively. The table further disclosed that the mean and standard deviation of post-test score of scientific attitude were found to be 163.97±11.59 in experimental group and 163.51±13.12 in control group. The effectiveness of experiential learning intervention programme was revealed with the results where the improvement is twice as compared to control group. The graphical presentation of mean of scientific attitude in pre-test

and post-test scores among experimental and control group is given in Figure 2

Fig. 2 Graphical Presentation of Mean of Scientific Attitude in Pre-test and Post-test Scores among Experimental and Control Group



It was depicted in above chart that there is a statistically significant positive change in both experimental and control groups. Here, it was pertinent to observe that the gain in experimental group as the result of experiential learning intervention programme is double as compared to control group which was taught through traditional method. So it can be concluded that experiential learning programme has a significant positive effect on secondary school students towards scientific attitude as compared to traditional teaching.

Discussion

The research findings concluded that teaching through experiential learning programme is very effective for the development of scientific attitude among learner than traditional method of teaching. The findings of the present study are in agreement with the studies, conducted by Alexender (1995) suggesting that the best way to develop scientific attitude among learner is through science teaching based on experiential learning. The present study is also in line with studies conducted by Mir and Jain (2015), emphasizing the constructivism approach, inquiry based learning and problem solving methods etc.which are functional aspects of meaningful learning than traditional method of teaching.

Chaudhari (2015) and Abed (2016) suggested that science excursions, drama and debate in science teaching is capable of generating curiosity for many scientific concepts and thereby changing the attitude towards learning. Jeffery et al. (2016) concluded that academic experience in science is helpful in developing belief and positive attitude towards science subject, even low performing students can do better by giving them additional opportunities for experiential learning activities. Oser and Fraser (2015) similarly established that students can benefit from alternative learning environment that is extended beyond class-room. The virtual laboratories are encouraging students to have scientific thinking skill, attitude toward science and achievement.

Conclusion

The results of the study indicated that experiential learning programme helped the students to develop scientific attitude among students as compared to the students taught through traditional method. The inquiry based activity, project activity, constructive approach, web based media approach, effective teaching aids and indoor and outdoor activities etc. were highly motivating by creating a suitable environment and increasing interest among learner. These experiential learning activities were capable of developing positive attitude in students for science than other students who were taught through traditional method of teaching.

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