

EFFECT OF INQUIRY BASED INSTRUCTION ON STUDENT'S ATTITUDE AND ACADEMIC ACHIEVEMENT IN PHYSICS

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ABSTRACT: *This study was carried out to explore the impact of inquiry based instruction on student's attitude and academic achievement towards Physics at secondary level. A sample of 50 science students was randomly selected from population. Pretest and posttest equivalent group experimental design was used in this study. The data was collected by administering pretest, posttest, and attitude towards physics questionnaire. The experimental group received inquiry based instruction while control group received instruction by lecture method. The performance of experimental group on posttest was found better than control group. Moreover, inquiry based instruction had positive impact for the improvement of student's attitude towards physics. The findings revealed that inquiry based instruction is more effective than lecture method for learning Physics. Efforts must be tailored to teach physics through inquiry method as it is helpful for improving attitude towards physics and enhancing academic achievement.*

Keywords: Inquiry based Instruction; Traditional teaching lecture approach; Achievement; Attitude towards Physics

1. INTRODUCTION

Science has changed societies in many ways by bringing different approaches in numerous fields of life. Economy is key ingredient of a society, and science is contributing enormously for the socioeconomic advancement of societies. Therefore, it is important to inculcate scientific point of view in the general population, so that youngsters embrace science education and decide to pursue scientific careers. It can be possible by using innovative teaching methodologies. The effective teaching can nurture the abilities of students and produce positive attitude. According to the philosophy of science, the key objective of science teaching is to improve problem solving skills of students. When we look at the complications of teaching learning process, physics is considered the most complicated subjects not only by the students but also by the teachers. The studies have revealed that students are taking less interest and attention in choosing science as studies or professions. Immense research has been conducted in order to find out ways to achieve excellence in science education and to increase number of admissions in science classes. Students' attitude is one of the main influencing factors for science learning. Student's participation in science courses and science related profession can be enhanced by their positive attitude towards science [1, 2]. Most of the students show less importance towards science lectures that's why they do not choose science subjects especially physics subject. Students face difficult for understanding concepts of physics [3]. Many studies revealed that achievement in physics is not more than the achievement in other subjects [4, 5, 6]. Therefore, if carefully planned and conducted, inquiry teaching based instruction can yield positive effect on the student's learning environment and improvement in science scores [7]. During laboratory experiments, students explore a huge range of materials and discuss the scientific concepts more deeply as compared to their peers from non-enquiry classes [8]. The process of planning, conducting, recording and evaluating student's investigations is a way to explore student's enthusiastic learning by the support of their teachers [8]. Scientific attitudes are either a combination of a number of mental habits or predispositions to attend new or problematic situations [9]. The scientific aptitude expresses the behavior of the learner for science learning. Ineffective science

teaching and putting less interest towards practical activities make science learning not only less interesting but also less long lasting [10]. In order to expand scientific attitude among students, practical experiences must be provided [11]. That is why an inquiry-based approach has a positive impact on students' academic achievements. In the present study, the academic achievement of the students in physics at secondary level as well as effectiveness of inquiry based instruction on their attitude have been explored.

2. MATERIAL AND METHODS

2.1 Research Design

Pretest-Posttest equivalent group experimental design was used for this study. A sample of fifty (50) ninth grade female science students was randomly selected from district Gujranwala.

2.2 Treatment

Welch, Klopfer, Aikenhead & Robinson [12] stated that the most important elements of science inquiry skills are to observe and interpret the data. In this study, inquiry based instruction was planned and executed with the emphasis on gathering and interpreting data by students for the improvement of students' learning in physics and positive attitude towards physics. Two equivalent groups were formed on the basis of pre-test and attitude questionnaire. One group was considered as experimental group and other group was considered as control group. There were 25 female students in each group. Inquiry based instruction was provided to the experimental group in the Physics laboratory. Guided inquiry model was used in this study, where students were given a question to inquire. Students were asked to design the method of investigation so that they can get the answer of the question. Necessary material was provided to the students of experimental group for every inquiry. Eight questions were formulated for the inquires. Each inquiry continued for two weeks (two hours each week). In the first week students were involved in inquiry process. In the second week, the students were asked to communicate their results to the Physics teacher and class mates. On the other hand, the control group was taught by lecture method in normal classrooms. Experimental group received treatment for a period of sixteen weeks. After treatment, attitude towards Physics and posttest were administered to find the effect of treatment on the

student's attitude towards Physics and their academic achievement.

2.3 Research Tools

For this study, pretest and posttests based on multiple choice formats were administered. There were fifty multiple choice questions in both tests. The difficulty and discriminatory indexes of both tests were measured. Moreover, the attitude towards Physics questionnaire was constructed on Likert five point scale. According to Sarrmah & Hazarika quoted Best et al., "it is very crucial to assess the quality of the measurement. Hence, every classroom assessment measure must be appropriately reliable and valid so that the conclusions could be drawn from the measures become authentic. The measure must first be reliable before it can be valid" (p.508) [13]. Therefore, all the research tools were validated and made reliable. The pretest and posttests have reliability 0.91 whereas, the attitude questionnaire was validated by subject experts, and its reliability was found through pilot testing. The split half reliability of the questionnaire was 0.85.

3. RESULTS AND DISCUSSION

The data was analyzed and tabulated for presentation. Different statistical tools such as mean, standard deviation and paired T-test were applied to calculate difference between the two groups. Statistical Package for Social Sciences (SPSS) was used for data analysis.

Table 1. Comparison of mean scores of experimental and control group on Pre-test

| Learning Domain | Group | n | Means scores | S.D | T _{cal} | P |
|----------------------|---------|----|--------------|-------|------------------|-------|
| Academic achievement | Exp. | 25 | 26.0400 | 2.440 | 1.809 | 0.083 |
| | Control | 25 | 26.1600 | 2.374 | | |

T_{tab} at 0.05 Level of Significance = 2.064 df = 24

Table 1 shows that the mean score of experimental group was almost equal to the means score of control group. The calculated value of T-Test was less than the tabulated value of T-Test i-e 0.83 < 2.064. Therefore, there was no significant difference between the mean scores of experimental and control group on pretest of academic achievement. It shows that the academic achievement of both groups was almost equal prior to the treatment.

Table 2. Comparison of the attitude on "Pre-test of attitude towards Physics"

| Variable | Group | n | Means scores | S.D | T _{cal} | P |
|--------------------------|---------|----|--------------|------|------------------|------|
| Attitude towards Physics | Exp. | 25 | 2.600 | 1.15 | 0.462 | 0.64 |
| | Control | 25 | 2.4720 | 0.71 | | |

T_{tab} at 0.05 Level of Significance = 2.064 df = 24

Table 2 shows the mean score responses on attitude towards Physics questionnaire. The mean score of experimental group towards Physics was approximately equal to that of control group. The calculated value T-Test was less than the tabulated

value of T-Test i-e 0.462 < 2.064. It shows that there was no significant difference between mean score regarding responses on attitude towards Physics before the treatment. It shows that the attitude towards physics of both the groups was almost same prior to the treatment.

Table 3. Comparison of mean scores of experimental and control groups on Post-test

| Learning Domain | Group | n | Mea ns scor es | S.D | T _{cal} | P |
|----------------------|---------|----|----------------|------|------------------|------|
| Academic achievement | Exp. | 25 | 28.44 | 2.53 | 22.01 | 0.00 |
| | Control | 25 | 44.68 | 3.15 | | |

T_{tab} at 0.05 Level of Significance = 2.064 df = 24

Table 3 shows that the mean score of experimental group on posttest. The calculated value of T-Test is greater than the tabulated value of T-Test i-e 22.013 > 2.064. The P value shows significant difference between the mean scores of both the groups on posttest. It shows that both groups were not equal regarding academic achievement and as the performance of experiment group had been improved a result of treatment.

Table 4. Comparison of the attitude on "Post-test of attitude towards Physics."

| Variable | Group | n | Means scores | S.D | T _{cal} | P |
|--------------------------|---------|----|--------------|------|------------------|------|
| Attitude Towards Physics | Exp. | 25 | 2.63 | 0.65 | 6.496 | 0.00 |
| | Control | 25 | 3.92 | 0.95 | | |

T_{tab} at 0.05 Level of Significance = 2.064 df = 24

Table 4 shows the mean score of experimental and control group regarding attitude towards Physics. The mean score of experimental group regarding attitude towards Physics was greater than control group. The calculated value of T-test was greater than the tabulated value of T-Test i-e 6.496 > 2.064. It shows the significant difference between mean scores responses of both groups regarding attitude towards Physics after treatment. Hence, both groups were not considered equal with respect to attitude towards Physics as the experimental group displayed improved attitude towards Physics than control group due to treatment.

4. DISCUSSION

In this study, no significant difference has been observed between the attitude of students and academic achievement on pretest. This finding is line with other researches concerning academic achievement [14] and scientific attitudes [15]. However, after inquiry based instructional treatment for sixteen weeks, the experimental group showed outstanding greater physics achievement than did the control group. It might be due to the reason that students who received the treatment had the chance to observe, record and interpret the data while engaging hands-on investigative activities. As a consequence, the "basic and integrated science process skills" accentuated during these studies might

have helpful to the experimental group for learning Physics content in a better way compared to control group. The findings of both comparisons are in line with other studies, which displayed the positive impact of inquiry based instruction on student's academic achievement in science. There is overall noteworthy effect of inquiry-based teaching achievement in physics. The conclusions are consistent with other researches[16,17,18,19], which shows a positive relationship between science achievement and inquiry-based instruction. The researchers [20] emphasized that students must be provided opportunities where they can appreciate and understand different types of scientific inquiry. Inquiry can be adopted by different approaches, ranging from guided inquiry to structured inquiry or open inquiry²¹. The researchers [22,23,24,25] also endorsed that there exists a positive relationship between academic achievement and students' attitudes toward science. Students develop positive attitudes toward science where they are encouraged to engage in science inquiry. Many researchers have observed the effects of inquiry base teaching on student's attitude along with academic achievement [26]. The inquiry based teaching is recorded effective in improving students' attitude towards science and their academic achievement[27]. The inquiry based teaching is also used in other disciplines like technology. Every type of inquiry approach produce positive impact on attitudes and learning[28]. As measured by the Watson Glaser, Inquiry-based learning (IBL) boosts critical-thinking ability[29]. If the teachers have positive believe in inquiry based teaching, improvements in students learning can be brought. Zacharia[30] assured that our beliefs affect attitudes and then these attitudes affect our intentions[31]. The role of teacher is very much essential for the improvement of academic achievement and attitudes of students. It is possible only when a teachers are equipped with the essential characteristics i-e novel style of pedagogical and scientific thinking, create new values, take creative solutions eagerly, the capacity for reflection, individual style of pedagogical activity and the desire for continuous self-education and commitment[32].

5. CONCLUSIONS

Following are the conclusions of this study:

1. For teaching physics at secondary level, the inquiry based Instruction is more effective than traditional teaching lecture approach.
2. Inquiry based instruction provides hands on experiences for the understanding of Physics concepts and hence yields better learning
3. Inquiry based instruction develops positive attitude towards Physics among science students.

6. REFERENCES

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