



“ACADEMIC ACHIEVEMENT OF BIOLOGY DISCIPLINE THROUGH LABORATORY STRATEGY OF INSTRUCTION AT SECONDARY SCHOOL LEVEL”

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ABSTRACT:

The study explores the academic achievement of Biology content through laboratory strategy of instruction at secondary school level is a unique source of quality teaching and learning in science because science students are able to observe and manipulate materials to demonstrate certain aspects of the subject matter in the class through lectures, demonstration and text book. Its significance indicates how the proposed research will refine, revise or extend existing knowledge in the area under investigation. The study conducted through experimental approach investigating comparison of traditional and laboratory method, controlled and experimental group, boys and girls and pre and post test on academic achievement through laboratory strategy. 60 students of class 9th standard as samples and two matched group design was adopted. Gender, age, achievement and validated biology content etc. were the variables correlated. 't' tests and 'r' techniques were employed to measure the achievement of biology content through laboratory strategy. Both quantitative and qualitative data analysis was done on the data collected. Major findings of the study were a significant impact of laboratory instruction on the academic achievement and a significant difference between boys and girls.

Key Words: Academic Achievement, Biology, Laboratory Strategy Of Instruction, secondary school

1. Introduction:

Science educators have believed that the laboratory is an important means of instruction in science since date in the 19th century. Laboratory instruction strategy considered essential because it provided training in observation, supplied detailed information, and aroused pupil's interest. This same reason are still accepted almost 100 years later. In a laboratory, students work independently or in small groups on a question, problem of hypothesis. They use the process and materials of science to construct their own explanation of scientific phenomena. The distinction between laboratory and traditional classroom learning is that activities are student centred, with student actively engaged in hands on, minds on activities using laboratory techniques.

Laboratory method is a unique source of quality teaching and learning in science because science students are able to observe and manipulate materials to demonstrate certain aspects of the subject matter which has won class through lectures, discussion and textbook. Hence, laboratory method provides students with opportunities to engage in process of investigation and unitary which is believed to enhance quality education. Laboratory experiments take place in control environment and are the main method used in the natural science such as physics, chemistry, and biology. The logic of the laboratory method is that it is a control environment which enables the scientist to measure preciously the effects of independent variables on dependent variables, does establishing cause and effect relationship. This intern enables them to make predictions about how the dependent variable will act in the future.

2. Biology and Biology teaching:

Science is a dynamic, expanding body of knowledge covering ever new domains of experience. Science gives an opportunity of critical thinking, and integrates human beings concepts of natural environment in settlement of the environment. Biology is considered a difficult subject by students as well as teachers because they face many problems in teaching and learning process. This problem is due to the traditional approach of teaching strategy of biology because this approach

nether produces good results nor fulfills the contemporary requirement of country. In the traditional teaching i.e lecture method the students always remain passive

3. Laboratory method of instruction:

The above problem can be minimized to its required level if teaching learning process should be done through laboratory activities. This study is to determine the effectiveness of laboratory method of instruction on academic achievement in biology subject. Teaching of biology through laboratory method is very efficient and everlasting process and it creates interest among the students towards the science subject especially in biology subject at secondary level. Activity based learning process in science subject is practiced in many countries of the world.

4. Strategies for effective use of laboratory approach:

- 1) A good science teacher should maintain an active role and consistent pace of interacting throughout the laboratory period so that students learn what to do you expect from him an instructor
- 2) He should include several moments of whole class instruction at key points in the laboratory
- 3) Teachers should gain everyone's attention and use this moment to provide targeted just in time "instruction for feedback for everyone.
- 4) Teachers should be aware of the progress of all students team, addresses by name whether he gets the chance, and listen to what is being said in group to help you anticipate and diagnose instruction problems
- 5) Teacher can diagnose a club rotary problem early on by observing what is being done or said in seemingly on truck group
- 6) It is always useful and never unappreciated for a teacher to approach a group and promote them with "he should tell them what he is doing" to find out if they are on the right track.

5. Principles of laboratory method

- 1) It follows the principle of learning by doing
- 2) It follows psychological principle, student's age and interest is taken into consideration
- 3) The work should be free, organized and preselected
- 4) Students are allowed to work independently without much interference
- 5) Apparatus and equipments should be checked before hand

6) Students are able to follow instruction and record their observation properly

6. Role of teacher in laboratory method

- 1) Teacher must be a facilitator of the process of doing experiments by students
- 2) Teacher must check the apparatus previously so that it goes on smoothly
- 3) The practical work must be organized and pre-selected
- 4) The skill of handling apparatus, drawing, diagrams carefully and observations taking necessary precautions must be developed among students
- 5) The teacher must watch the student is doing experiments properly by following proper procedure

7. Aims of laboratory method

- 1) To give first hand experience to students
- 2) To provide student participation in original research
- 3) To develop skill in the use of laboratory equipment and instructions
- 4) To make use of the power of observation and reasoning
- 5) To make use of reality to make learning easier and permanent
- 6) To build scientific attitude in the students

8. Steps in laboratory method

1. Preparation/introduction :

In this step which provides for motivation and orientation, the following factors should be taken into account

a. Determination of laboratory work to be done: this step is an extension of the problem or other work to be done-this may be called presentation. Here is the teacher's opportunity to motivate the students

But if the work is to be planned cooperatively by the students and the teacher, the first step is to determine by means of class discussion and the nature of the problem of the work to be done

b. Determination of the plan of work: the second step is too got clearly in mind what is to be done. This may be set forth by the teacher who gives the necessary directions for both individual and group work. Since this work is likely to take more time than one period. It consists of various activities, written directions in the form of guide seeds, manuals, workbooks and so on should be used

The introductory step does consider the problems in the objectives of the work , plan of work to be carried out. After considering the first step we now discuss the second one work period

2. Actual work period:

the activities should take the form of a supervised work period in which groups of individuals have their particular work to do. The students can work individually or collectively on a particular problem or on a particular problem or on different problems. Directions must be very specific. The length of the work areas should be determined by the nature of the problems in the objectives

If the laboratory work occupies several days, it may be desirable to have the classmate's age group each day preferably at the beginning of the period for a discussion of the problems, progress and to receive criticism, suggestions for directions from the teacher

9. **Statement of the problem**

“Academic achievement of biology discipline through laboratory strategy of instruction at secondary school level”

10. **Review of related literature:**

1. **Jagannadhan (2003)** analyzed the impact of certain socio psychological variables on students' academic achievement studying in classes 8th to 10th and found that a significant effect of home environment on academic achievement. The relationship between home environment and academic, achievement was also significant.
2. **Babu et al. (2008)** examined whether there was any significant difference in locality, gender and family type with respect to higher secondary student's achievement in accountancy and found that there was significant low relationship achievement in accountancy and parental encouragement of higher secondary students; no significant relationship was found in respect to achievement in accountancy and parental encouragement for female students.
3. **Mittal (2008)** analyzed academic achievement of 10th class students in relation to their locality and mental health. A sample of 640 secondary level students was taken. The findings of the study revealed that “there was a significant difference in academic, achievement of secondary school, students of different localities; students of urban areas was found better in academic, achievement as compared

to their counterpart rural students. He further stated that students of urban areas had better teaching-learning environment at home as well as at school than rural locality students. A significant and positive relationship was found between mental health and academic, achievement of students of urban locality, while was no significant, difference was found between mental health and academic, achievement of secondary level students belonged to different localities”.

- 4. Abubakar and Adegboyega (2012)** examined gender and age as determinants of academic,achievement of students of Mathematics. A low positive correlation was found for ages and gender, which was not significant.

11.Objectives of the study

1. To develop and validate the lesson plans based on the steps of laboratory method
2. To compare the effects of traditional and laboratory method on the academic achievement
3. To study the difference between controlled and experimental group on academic achievement
4. To study the difference between boys and girls in their academic achievement after the experimental treatment
5. To examine the academic achievement between pretest and posttest of experimental group

12.Research hypotheses:

1. There is a significant difference between traditional and laboratory method on academic achievement
2. There is a significant difference academic achievement of control and experimental group
3. There is a significant difference between academic achievement of boys and girls after treatment
4. There is a significant difference between academic achievement of pre-test and post-test of experimental group

13. Operational terms defined:

- 1) **Laboratory:** a place where providing opportunities for experimentation
- 2) **Instruction:** the action or process of teaching
- 3) **Academic:** courses of studies taken at a school
- 4) **Achievement:** the quality and quantity of students work usually in the form of marks
- 5) **Biology:** a branch of knowledge that deals with living organisms and vital processes in science discipline
- 6) **Secondary school level:** schooling for students between the ages of 11 to 16 or 18

14. Methodology/Design of the study:

14.1. Method of the study:

Experimental method with two matched control and experimental group design was used.

14.2. Sample and Sample method:

The investigator adopted random sampling technique and selected 60 students of 9th standard and 30 students of each control and experimental groups were matched statistically

14.3. Treatment (laboratory strategy of instruction):

Experimental method with two matched control and experimental group design was used. After experimental treatment data was collected on both the groups as marks scored. The investigator adopted random sampling technique and selected 60 students of 9th standard and 30 students of each control and experimental groups were matched statistically. The lesson plan in biology content is prepared, developed and validated based on the steps of laboratory method of instruction and administered to the experimental group as a major tool of research.

14.4. Statistical techniques used:

Mean, Slandered deviation and 't' test is used for analyzing the data for its significant difference on the well defined variables of the study.

15. Data analysis and interpretation:

Data collected for the purpose was analysed and interpreted based on the hypotheses which are presented below;

1. Research Hypothesis-(Ha): There is a significant difference between traditional and laboratory method on academic achievement

Null Hypothesis (H₀): There is no significant difference between traditional and laboratory method on academic achievement

Table-1:

Mean, S,D and t-value of Pre and post test scores of controlled group

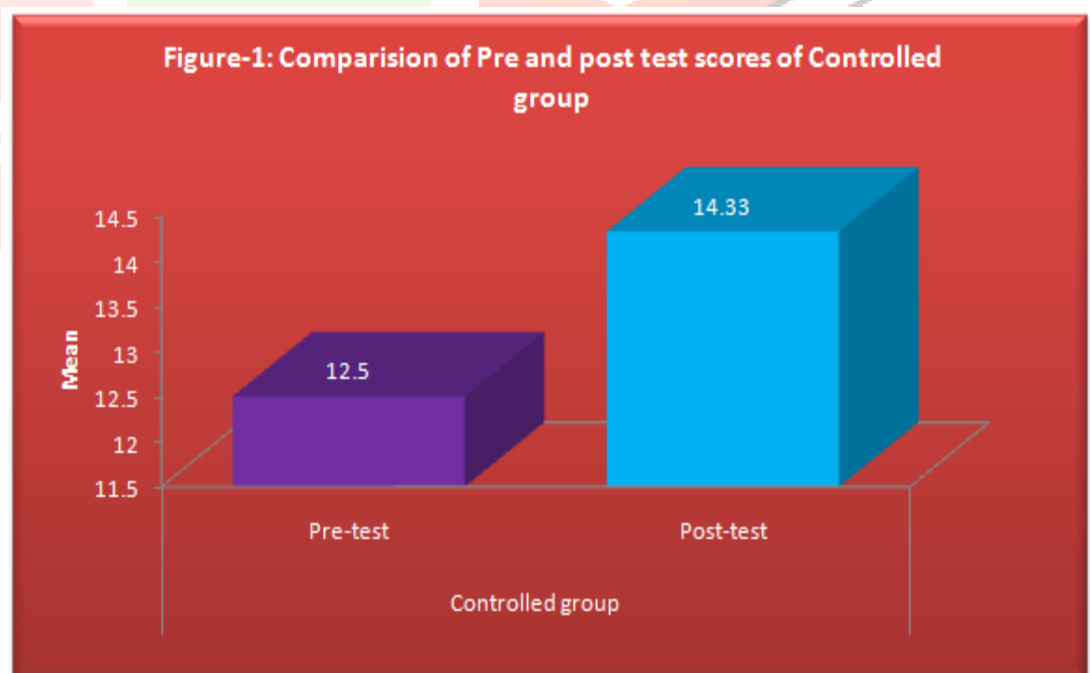
Group	Variables	N	Mean	SD	t-value
Controlled group	Pre-test	30	12.50	5.043	2.73*
	Post-test	30	14.33	4.281	

Table t-value at 0.05 and 0.01 is 2.00 and 2.66 respectively

* significant at 0.05 and 0.01 level of Significance

Interpretation:

The above table shows that the obtained 't' value is greater than the table 't' value at 0.05 level and hence the stated null hypothesis is rejected and alternative hypothesis that is research hypothesis is accepted. The data can shown effectively with bar diagram as follows



2. Research Hypothesis (Ha): There is a significant difference between traditional and laboratory method on academic achievement is converted into as

Null Hypothesis-(H₀): There is no significant difference between traditional and laboratory method on academic achievement

Table-2:**Pre and post test scores of experimental group**

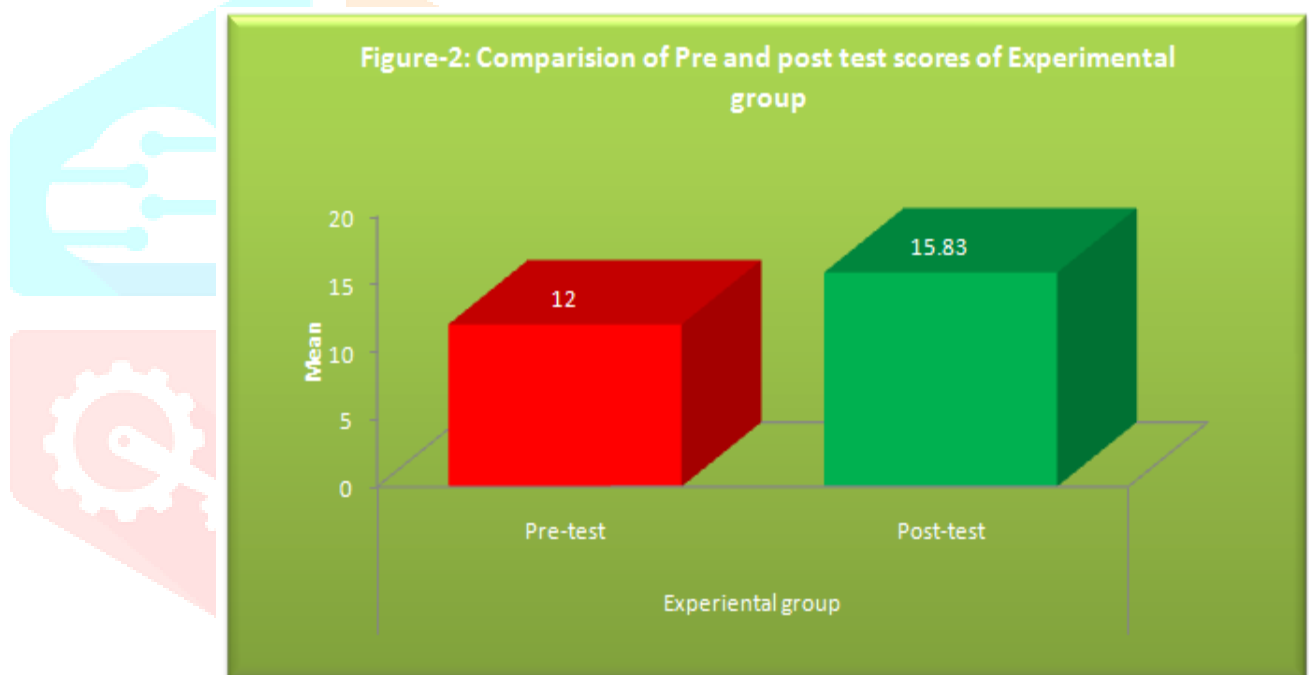
Group	Variables	N	Mean	SD	t-value
Experimental group	Pre-test	30	12.00	3.50	3.83*
	Post-test	30	15.83	4.345	

Table t-value at 0.05 and 0.01 is 2.00 and 2.66 respectively

* significant at 0.05 and 0.01 level of Significance

Interpretation:

The above table shows that the obtained 't' value is greater than the table 't' value at 0.05 level and hence the stated null hypothesis is rejected and alternative hypothesis that is research hypothesis is accepted.



3. Research Hypothesis-(H_a): There is a significant difference between academic achievement of control and experimental group

Null Hypothesis-(H₀): There is no significant difference between academic achievement of control and experimental group

Table-3:**Academic achievement of controlled and experimental group**

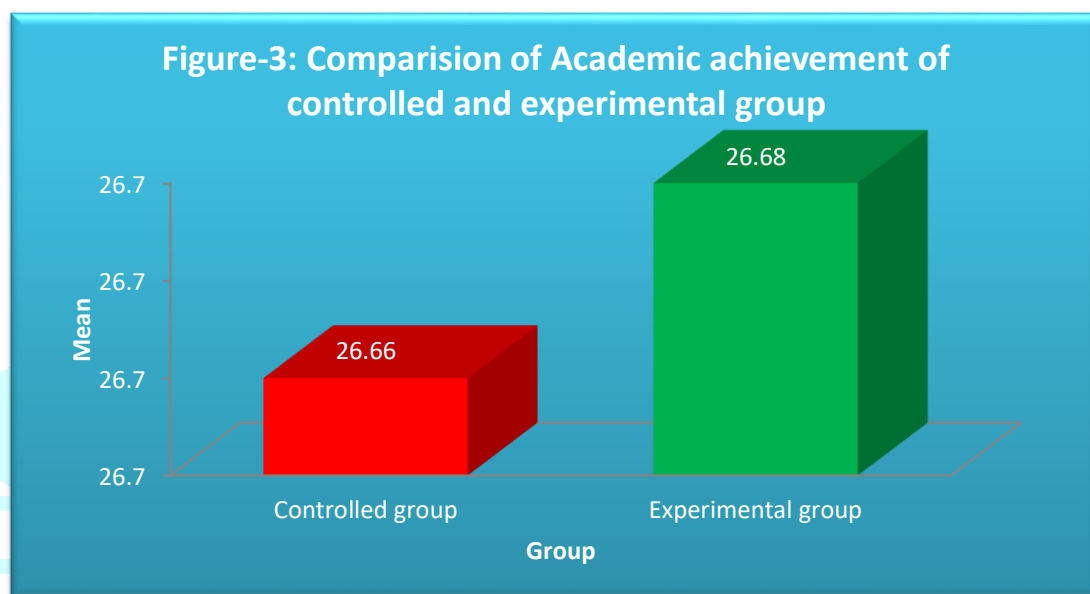
Group	N	Mean	SD	t-value
Controlled group	30	26.66	5.216	3.037*
Experimental group	30	26.68	4.533	

Table t-value at 0.05 and 0.01 is 2.00 and 2.66 respectively

* Significant at 0.05 and 0.01 level of Significance

Interpretation:

The above table shows that the obtained 't' value is greater than the table 't' value at 0.05 level and hence the stated null hypothesis is rejected and the alternative hypothesis that is research hypothesis is accepted



4. Research Hypothesis-(H_a): There is a significant difference between academic achievement of Boys and Girls

Null Hypothesis-(H₀): There is no significant difference between academic achievement of Boys and Girls

Table-4:

Academic achievement of Boys and Girls after Treatment

Variable-Sex	No. of students	Mean	SD	t-value
Boys	30	14.33	4.281	2.95*
Girls	30	15.83	4.345	

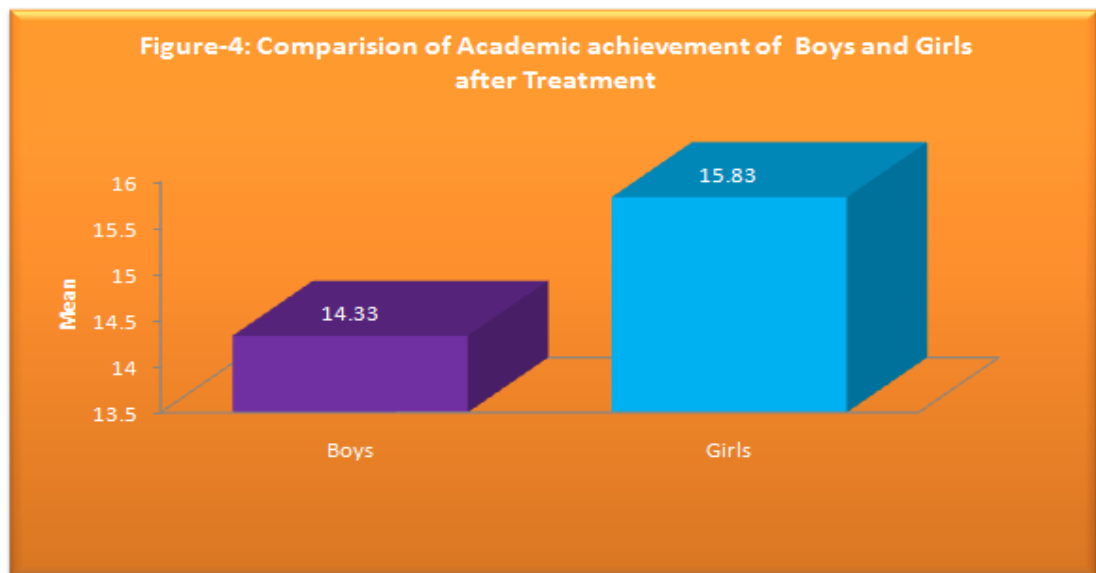
Table t-value at 0.05 and 0.01 is 2.00 and 2.66 respectively

* Significant at 0.05 and 0.01 level of Significance

Interpretation:

The above table shows that the obtained 't' value is greater than the table 't' value at 0.05 level and hence the stated null hypothesis is rejected and the alternative hypothesis that is research hypothesis is accepted

alternative hypothesis that is research hypothesis is accepted



- 5. Research Hypothesis-(Ha):** There is a significant difference between academic achievement of pre-tests of both control and experimental group is converted into as
- Null Hypothesis-(H0):** There is no significant difference between academic achievement of pre-tests of controlled and experimental group

Table-5:

Academic achievement of pre-tests of controlled and experimental group

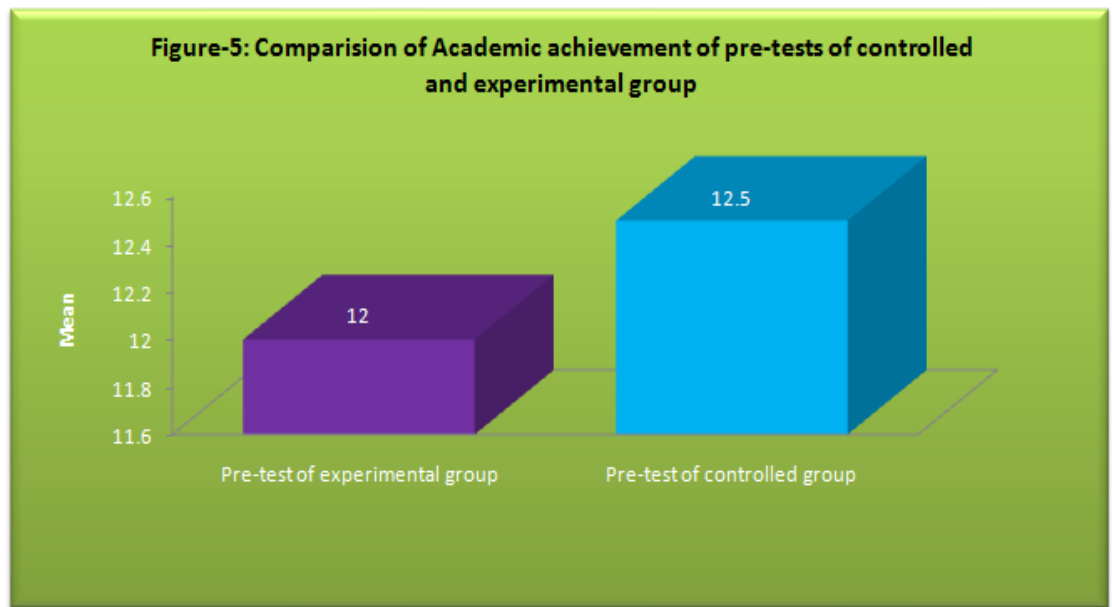
Variable	N	Mean	SD	t-value
Pre-test of experimental group	30	12.00	3.50	0.99*
Pre-test of controlled group	30	12.50	5.043	

Table t-value at 0.05 and 0.01 is 2.00 and 2.66 respectively

* Not significant at 0.05 and 0.01 level of Significance

Interpretation:

The above table shows that the obtained 't' value is less than the table 't' value at 0.05 level and hence the stated null hypothesis is accepted.



- 6. Research Hypothesis-(H_a):** There is a significant difference between academic achievement of post tests of experimental and controlled group is converted into as **Null Hypothesis-(H₀):** There is no significant difference between academic achievement of post tests of experimental and controlled group

Table-6:

Academic achievement of post tests of experimental and controlled group

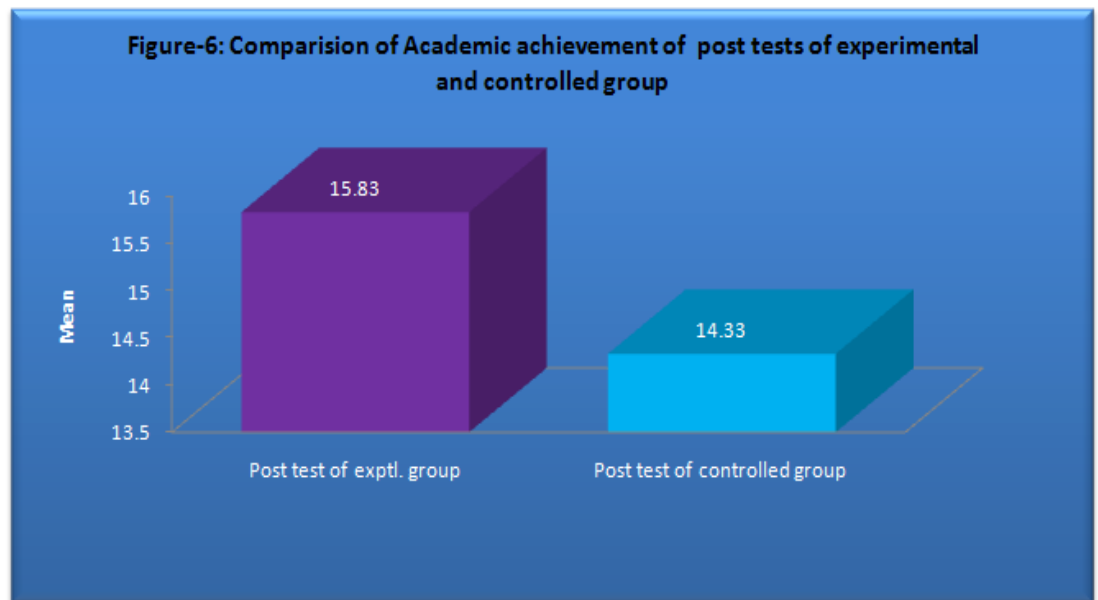
Variable	N	Mean	SD	t-value
Post test of exptl. group	30	15.83	4.345	2.95*
Post test of controlled group	30	14.33	4.281	

Table t-value at 0.05 and 0.01 is 2.00 and 2.66 respectively

* Significant at 0.05 and 0.01 level of Significance

Interpretation:

The above table shows that the obtained 't' value is greater than the table 't' value at 0.05 level and hence the stated null hypothesis is rejected and the alternative hypothesis that is research hypothesis is accepted.



16. Conclusion:

1. There is significant increase in the individual scores in the post tests of the experimental group through the Laboratory teaching method and the control group through the traditional method when compared to their respective pre-test scores.
2. The mean score of the post test conducted to the experimental group through the Laboratory teaching method is higher than the control group taught through traditional method to the IX standard students.
3. The mean achievement score of the post test conducted to the experimental group through the Laboratory teaching method is which is higher than the post test of the control group through traditional method to the IX standard students. There is significant differences exist between the mean scores of the pre test and post test.
4. It is inferred that the level of percentage in post test of control group is found to be higher than the Pre test. It is inferred that the level of percentage in post test of experimental group is found to be lower than the Pre test..The level of achievement in Science in Post test of experimental group is higher than the Post test of control group.

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