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A Study On The Effectiveness Of Experiential Learning Through Activity Based Learning Method In Enhancing Academic Achievement Of Science Students At Secondary Level

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Abstract
In recent years, the effects of employing activity-based learning methods in the classroom as opposed to conventional learning techniques, as well as whether or not they are suitable for raising student achievement, have been the subject of a continuous discussion. In order to address the issue of low performance in science, it is necessary to enhance teaching methods. Therefore, this research is aimed to ascertain the effects of experiential learning strategy (activity-based learning methods) on academic achievement of science students in contrast to passive learning. This study used a sample of 60 students of 9th grade from CBSE board school, Agra and used a quasi-experimental research design method with a pre and post-test. They were split up into two groups: control group and experimental group. Traditional instruction was given to the control group, whereas an activity-based learning approach was used to teach the experimental group. Students' academic achievement of science was assessed by using a pre-test and post-test of a self-assessment test. By using the independent sample t-test, the collected data were analyzed, with a significance level ranging from 0.01 to 0.05. According to the study's findings, when compared to conventional teaching approaches, activity-based learning methods significantly impacted the student's academic achievement of science. Students believed that learning through activities improves comprehension, fosters a sense of accountability, makes the classroom more appealing, and boosts achievement. Thus, the study comes to the conclusion that activity-based learning method has a major influence on student's academic achievement of science.
Keywords *Experiential learning strategy, Activity based learning methods, academic achievements, science subject, and conventional teaching methods.*

INTRODUCTION

The activity based learning method is an integral part of experiential learning as it gives students practical experiences that help them to grasp the concepts more deeply. Experiential learning methods gives students' tangible experiences through practical applications including role-playing, group projects, experiments, and simulations. It incorporates reflection, conceptualization, and application, going beyond simple activity participation. The term "activity-based learning" refers to a variety of instructional strategies. Among its fundamental tenets is the insistence that Activity based learning should be the foundation of education. Activity-based learning, as its name implies, involves students actively to participate in the educational process. Student's enthusiasm for the learning process has diminished in the present circumstances due to traditional teaching methods, and they no longer perceive the learning process to be interesting.

In school, students can learn in two ways: passively or actively. By serving as knowledge repositories, they acquire knowledge passively and are not involved in the learning process. On the other hand, students learn more actively when they actively participate in the process rather than just listening. In the

classroom, passive seating will result in a loss of focus and attentiveness. While there are many tactics that teachers can employ in their classroom that help students to develop the skills and information needed to succeed in the real world and for this one of the most effective approaches is activity-based learning. It gives students the chance to collaborate with one another and fosters the generation of creative ideas, which makes learning fun.

Active participation of students in class is a key component of the most successful teaching and learning methodologies (Bhalli, Sattar, and Asif 2016). Effective teaching strategies raise accomplishment levels, foster the development of critical skills, and advance student comprehension. According to Churchill (2003), Students benefit from activity-based learning by "developing mental models that facilitate higher-order performance, such as information and skill transfer and problem solving." It is sometimes referred to as student-centric and aims to give all students demanding, interesting, and adaptable learning assignments (Singal et al. (2018). Students that use this learning approach receive encouragement and develop relationships with their peers, which boosts students enthusiasm and effort levels (Deci and Ryan 2000). The key focus of this study was to determine how well students' academic achievement of science was affected by the use of activity-based learning method.

Research Objectives

i. To study the effect of activity-based learning method on academic achievement of science students of experimental group.
ii. To study the effect of conventional method on academic achievement of science students of control group .

Research Hypothesis

- H0: There will be no significant effect of activity-based learning method on academic achievement of science students at secondary level.
- H0: There will be no significant difference in the academic achievement of science students of both experimental and control group students.

LITERATURE REVIEW

Constructivism is the foundation of activity-based learning, while behaviorism is the origin of the skills-based approach to education. Prior to constructivism, the behaviorist school emerged, which is mostly attributed to Russian scientist Ivan Pavlov (1849–1936).

Green, B. (2023) this study examined how the academic performance of junior school students in science was affected by activity-based learning strategies. 87 students participated in the study, and employed a quasi-experimental research design with pre and post-test control groups. The findings showed that students who were taught through activity-based methods did noticeably better than those who were taught through expository strategies. Empirical research on experiential scientific education and academic achievement is synthesized in a thorough literature review. The review assesses how hands on experiences enhance students' involvement, critical thinking, conceptual knowledge, and problem-solving abilities (Anaba, C. A., & Anaba, C. A. 2023).Activity-based learning improves students' performance in physics. Two groups of 20 students each were created by random assignment by using a pre and post-test control group approach. While the control group was instructed using conventional techniques, the experimental group got instruction based on activities. The control group performed worse than the experimental group according to the findings, demonstrating how activity-based learning can improve academic performance (Khan, M. S., & Chaudhry, A. M. 2023). In a constructivist context, Mehta, R. (2023) emphasized the theoretical foundation of science activity-based learning. The study emphasized how students gain higher-order thinking skills and do better academically when they actively participate in creating information through experiments and discovery-based tasks. Chen, L. et.al., (2024) recently investigated the effects of combining digital simulations with hands-on activities in science schools in Taiwan. A mixed-methods approach's findings supported the hybridization of digital and hands-on experiences by demonstrating that students exposed to blended activity-based learning demonstrated considerably greater levels of science engagement and achievement than those in traditional settings. Ahmed, S., & Hussain, R. (2022) investigated the effects of activity-based learning strategies on Pakistani middle school pupils' academic achievement. The study, which used an experimental design with 60 students, found that children who were taught through activities like experiments, model building, and group discussions performed better on scientific assessments than kids who were taught by traditional

techniques. According to the authors, students' physical participation improves their mental clarity and sparks their enthusiasm in science. In Punjab, India, a research by Kaur, G., & Kaur, P. (2023) examined how activity-based learning affected eighth-grade students' comprehension of scientific ideas. The experimental group was instructed through practical exercises using a quasi-experimental methodology, whilst the control group was given conventional lecture-based training. The experimental group's post-test scores improved statistically significantly ($p < 0.01$), according to the results, proving that activity-based learning helps students retain and comprehend scientific ideas more deeply. Reddy, B., & Rani, S. (2020) study, examined the affective and cognitive effects of teaching science in Indian schools through activity-based learning. Their research included both quantitative and qualitative methods, and they evaluated learning results using Bloom's taxonomy. According to the results, children in the experimental group not only did better academically but also had a more favorable attitude toward science, indicating that the strategy had overall benefits.

RESEARCH METHODOLOGY

When preparing the study, the researcher tried to choose the method that would best address the issue being studied. The choice of research methodology is contingent upon the nature of the objective that needs to be established so based on the objectives and need of the study quasi- experimental method was best suitable for this study.

Research Design: A pre-test and post-test design was used by the researcher with experimental and control groups. Before evaluating the effect of activity-based learning on science academic achievement, a pre-test of science was administer to both groups. After conducting pre-test control group was taught by lesson plans based on traditional method, whereas an activity-based lesson plans was used to teach the experimental group. For the purpose of comparing the pre and post test findings, a post-test was administered to both groups in order to investigate the effect of activity based learning method on science academic achievement of students. The study's research design is illustrated in table 1.

Table 1. Research Design of the study

Groups	Before intervention Phase	Intervention phase	After Intervention phase
Experimental group	pre-test based on science subject	30-lesson plans taught by using activity based learning method for 45 days.	post-test based on science subject.
Contr Control group	pre-test based on science subject	30-lesson plan taught by traditional learning approach for 45 days.	post-test based on science subject.

Sample of the study:

This study used a sample of 60 students of 9th grade from CBSE board school, Dayalbagh Agra. The experimental group (N=30) and the control group (N=30) were the two groups into which these students were divided.

Statistics used in study:

The researcher calculated the average mean, standard deviation, and independent t-test for interpreting and analyzing data in order to fulfill the study's goals.

Analysis And Interpretation Of Data

Analysis of the data is the next step in a research once the data has been collected. It is the computation of specific measures and the process of looking for trends or connections between data sets. Interpretation is the process of logically, carefully, and critically examining the outcomes of analysis while taking into account the constraints of the study's methods and sample. In light of the study's objective and variables, the collected data was examined and interpreted under the following headings: i) To study the effect of activity based learning method on academic achievement of science students at secondary level. ii) To compare traditional method and activity based method in relation to their effect on Academic Achievement of science students at secondary level.

For the attainment of these objectives, the researcher made following tentative hypothesis:

●Ha: There will be no significant effect of activity based learning method on academic achievement of science students at secondary level .

●Hb: There will be no significant difference in the academic achievement of science students of both experimental and control group students.

Attainment Of Objective And Testing Of Hypothesis

In order to attain the study's objectives, the researcher first split the entire class into two groups at random. Then, the researcher conducted Pre-test of science academic achievement test (self constructed) of each group in order to check their current status of the groups. Once the groups were equal, the researcher began the intervention, employing a regular teaching strategy for the control group and an activity-based learning approach for the experimental group. The researcher then used Post-test of science academic achievement test to examine the effect of the experimental treatment. Here is a thorough explanation and analysis of how the researcher met the objectives of the study: -

i) To study the Science Academic Achievement of Secondary Students before treatment

To measure the effect of Activity Based learning method in Science, a self-developed / constructed test of science was given to students to assess their academic achievement of science before teaching with Activity Based learning method. Frequency distribution of Pre-test scores of science Academic Achievement of secondary students is depicted in table 2.

Table 2: Frequency distribution of pre-test scores of Science Academic Achievement of Secondary Students

Class Interval (Marks Obtained)	Frequency (Number Of Students)
0-5	8
6-10	23
11-15	15
16-20	13
21-25	1
26-30	0

The above table 2 depicted that maximum students have scored marks between 6-10 and not a single student scored marks between 26-30.

Graphical representation of pre-test scores of secondary students are shown in the figure 1.

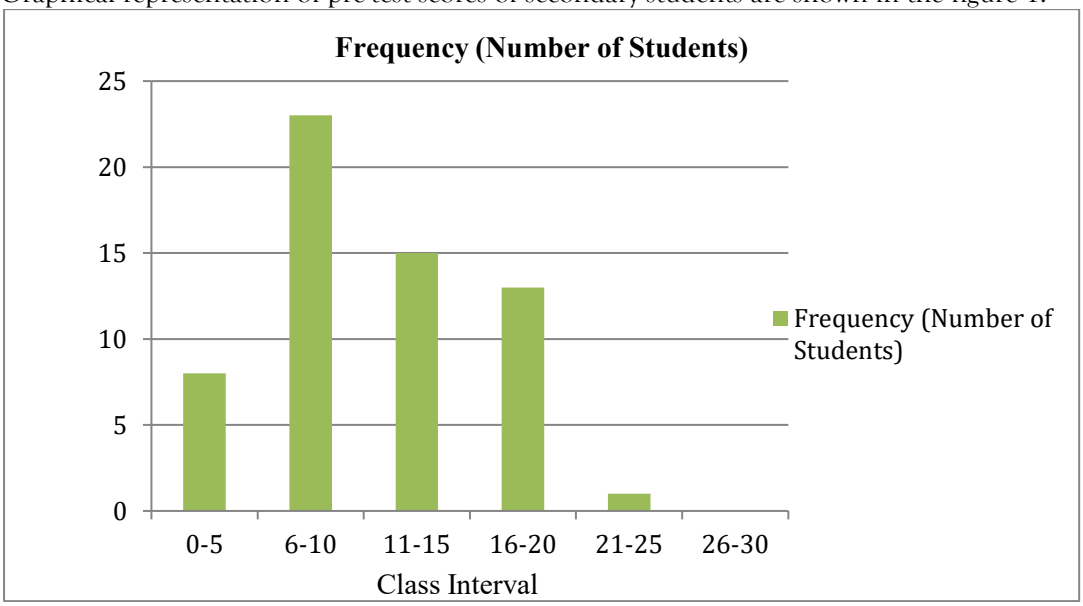

Fig 1. Graphical representation of pre-test scores of Science Academic Achievement of Secondary Student

The average mean, standard deviation, and independent t-test were used to depict the data collected from the secondary students' academic achievement in Science pre-test. The average mean, standard deviation, and independent t-test data given before to treatment is depicted in the following table 3.

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Table3: Exhibiting the Average mean, Standard deviation and t-test of pre-test scores of Science Academic Achievement test

Groups	No.of Students	Average Mean	Standard Deviation	t-test	Significance
Experimental	30	10.12	2.75	1.24	Insignificant at level of 0.05
Control	30	9.11	3.67		

The graphical representation of comparison of pre t-test scores of both experimental and control group is shown in figure 2.

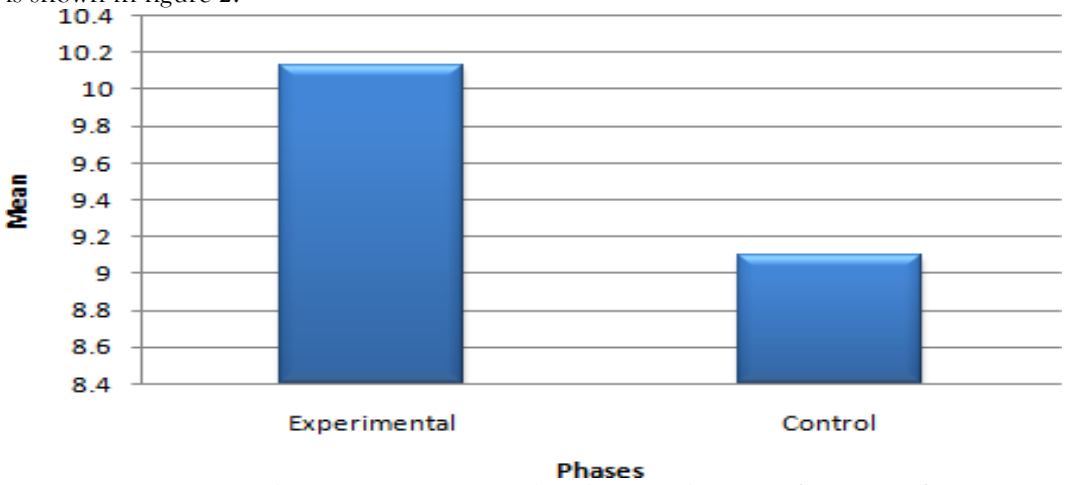

Figure 2. Comparison between Experimental and Control group of pre-test of Science Academic Achievement of secondary students

As shown in the table, the experimental groups mean and standard deviation of pre-test scores were 10.12 and 2.75, while the control group's mean and standard deviation were 9.11 and 3.67, respectively. With 28 degrees of freedom, the computed t-value of 1.24 was found to be less than the table value, which is insignificant at the 0.05 level. This t-value suggests that the pre-test results of secondary students did not significantly improve.

ii) To study the Science Academic Achievement of secondary students after treatment

To know improvement of the students in terms of Post-test scores of academic achievement test in science after the treatment on students.Frequency distribution of post-test scores of Science Academic Achievement of Secondary students is shown in table 4.

Table 4: Frequency distribution of post-test scores of Science Academic Achievement of Secondary Students

Class Interval (Marks Obtained)	Frequency (Number of Students)
0-5	0
6-10	9
11-15	14
16-20	16
21-25	11
26-30	10

The above table 4 showed that most of the students got score between 6-10 marks, 11-15 marks, 16-20 marks, 21-25 marks and 26-30 marks None of them scored below 6 marks. It showed that after administration of post test of science academic achievement, increment in marks was observed. Thus Activity Based Learning method was proved to be helpful for students to understand an retain the concepts. Graphical representation of post-test scores of secondary students are shown in the figure 3.

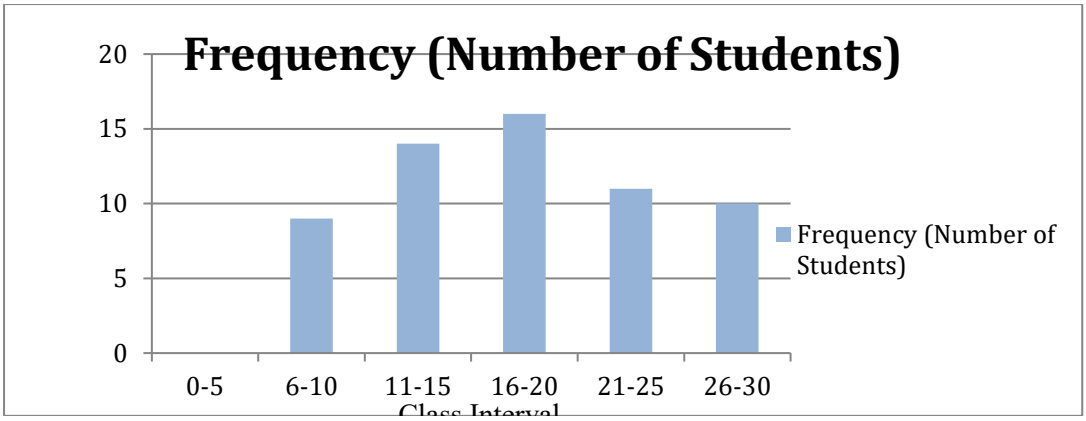

Figure 3. Graphical representation of post-test of Science Academic Achievement of Secondary Students

Data collected from secondary students' post-test results of science academic achievement test were depict in form of the Average mean, Standard deviation, and Independent t-test in table 5.

Table 5. Average Mean, Standard Deviation and t-test of post-test scores of Science Academic Achievement test

Groups	No.of Students	Average Mean	Standard Deviation	t-test	Significance
Experimental	30	18.65	3.85	4.70	Significant at the level of 0.05
Control	30	13.15	5.06		

The graphical representation of comparison of post-test scores of science academic achievement is shown in figure 4 this indicates that after receiving the treatment Students performed well in post-test of science academic achievement test.

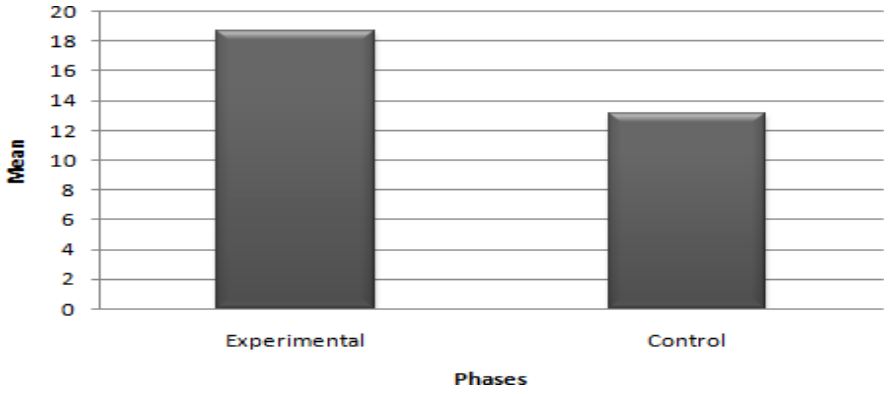

Figure 4. Comparison between post-test means of Science Academic Achievement of Secondary Students

According to the table, the experimental group's post-test mean and standard deviation were 18.65 and 3.85, while the control group's were 13.15 and 5.06, respectively. The estimated t-value, which is significant at the 0.05 level, was 4.70 with 28 degrees of freedom, which is more than the table value. This t-value suggests that post-test scores for secondary students in science was significantly improved.

Hence the hypothesis **"There will be no significant effect of Activity Based Learning Method on Science Academic Achievement of Secondary Students and there will be no significant difference in students Science Academic Achievement of both experimental and control group** was rejected. . Thus, it can be said that the Activity-Based Learning Method is successful in raising the Academic Achievement of Science students.

Findings Of The Study:

Findings of the study are as follows:

●Students in secondary school performed better academically in science while using the activity-based

learning approach.

●Based on the Average Mean scores of post-test of both groups,the experimental group clearly performed better than the control group. Therefore it is evident that students can apply the knowledge they have learned more successfully than those in the control group when they participate in an activity-based learning program.

●At the 0.05 level, it was determined that the t-value of control and experimental groups' post-tests was significant.

●The study's findings show that the experimental and control groups' post-test mean scores differed significantly, suggesting that teaching through activity-based learning improved science achievement. The students in the control group are unable to apply the knowledge they have learned as well as those in the activity-based learning program, which makes this point very evident.

CONCLUSION:

Activity-Based Learning method which is the integral part of the experiential learning, is a way to improve student performance in the classroom as well as making the class more dynamic. Students will have lots of chances to exercise their intellectual, creative, and imaginative faculties. This approach will also be beneficial from the teacher's perspective since it makes learning material more engaging and long-lasting.According to the study's findings, it is impossible to overstate the value of the activity-based learning approach in helping students to advance their cognitive capacities and meet learning goals. Students who were taught using the Activity technique outperformed those who were taught using the Traditional method in terms of achievement.The study's primary conclusions were that secondary students' academic performance in science was positively impacted by the activity-based learning method. Every successful and encouraging learning environment was produced by this innovative teaching strategy. Students' engagement and skill development were improved, and they can apply what they've learned and become proficient in the subject.The inclusion of the Activity Based Method in the curriculum would be a daring move in the direction of child-centered learning. There will be plenty of opportunity for students to exercise their intellectual, creative, and imaginative faculties.

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