



Effect of Ecological Approach in Science Learning on Secondary School Students' Achievement

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Abstract

This research investigated the Effect of Ecological Approach in Science Learning on Achievement of class X students of government model high school, Chandigarh. An ecological approach is a holistic approach which encompasses diversity, rather than being disconnected and specialized. It is modelled on ecology, where the focus is not only on the sum of the parts, but on the linkages and interactions between them. In the present study, Non-randomized Control Group Pre-test-post-test design was used. It was preceded by a qualitative phase which includes a preliminary survey to know perception of govt. secondary school students in Chandigarh Capital Region about science learning followed by quantitative phase which includes pre-test instructional program-post-test followed by feedback regarding their perception about Ecological Approach. Sample was selected by multi stage random sampling method. 95 students were selected each for control and experimental group. In total, 190 students were selected as sample of the study. The findings of the study revealed that ecological approach has positive and significant effect on the achievement in science of class 10 students. Also, it is found that students got motivated and became persistent in their learning process. This approach is helpful in motivating students for bringing new ideas of learning in threat free environment. It is also helpful in enhancing their interest in learning by active participation in learning process. Students themselves start taking initiatives when they are given freedom by altering classroom environment and building rapport. They actively participate in the classroom in different activities.

Introduction

In the 21st century, there has been a substantial knowledge explosion due to progression in science and technology as the capability and growth occurring in the country to a large extent



depends on the advancements in science and technology. The need for a skilled workforce, in conjunction with multidisciplinary abilities across the sciences, humanities, will be increasingly in greater demand. To make any education system successful, different reforms and changes are needed in the curriculum so as to cater with the increasing demands of present era of science and technology. Education must breed a skilled population and as such a highly trained manpower must emerge from educational institutions for a technology led development. Pedagogy must evolve to make education more experiential, holistic, integrated, inquiry -driven, learner-centered, flexible and enjoyable. Apart from physical participation of students in the class, it is important to involve their thoughts, ideas and surroundings into teaching. Teaching approaches thus must cater to the developmental needs of the students. Educationists have been suggesting integration of classroom learning with real life. With rising concerns about environmental issues, the contemporary focus is on linking learning interaction with environment through green curriculum” (Johnston and Carter, 2003). So, there is an urgent need of changing the process of teaching in order to improve the learning process. Ecological approach implements such teaching strategies in classroom that utilizes the developmental principles of human development. Also, in order to strengthen their teaching teachers need to combine the surroundings, real life examples and teach students through nature that would help them to understand the concept of ecological approach. In this context, the **Ecological Approach in Education** has emerged as a significant paradigm that views learning as a product of continuous interaction between learners and their natural, social, and cultural environments. The ecological approach emphasizes holistic development, sustainability, and contextual learning, making it highly relevant for modern education systems. “The ecological viewpoint is based on the understanding that the student and the learning environment mutually interact, learning is interactive and happens in relevant contexts. Ecological approach implements such teaching strategies in classroom that utilizes the developmental principles of human development. On the other hand, in order to strengthen their teaching, teachers need to combine the surroundings, real life examples and teach students through nature that would help them to understand the concept of ecological approach.



ECOLOGICAL APPROACH

“An ecological approach is a holistic approach which encompasses diversity, rather than being disconnected and specialized. It is modelled on ecology, where the focus is not only on the sum of the parts, but on the linkages and interactions between them. An ecological approach to basic education involves relating the people concerned to the subject being covered, while exploring the linkages between the sub issues and how their actions, or inaction, connect to the whole picture being studied. The subject and method are both linkage-based” (Foner, 2002).

Barton (2007) stated that “an ecological approach emphasizes diversity and sees it as a virtue: diversity is a source of strength, the roots of the possibilities of the future. Teaching through ecological approach provides opportunities to the students to apply scientific concepts and reasoning to real life problems. It also helps in developing knowledge through the use of real world. It meets the learning needs of individual students and group of learners and meets their varying needs. It also helps students to develop social skills by creating content for interactions. In addition to improve academic performance and to cultivate more positive environmental behaviors, ecological approach has been found to lead to greater motivation towards learning and to improve self-esteem. Thus, ecological approach is learning from surroundings and through doing. It is the process through which individuals construct knowledge and acquire skills from direct contact with immediate environment. It occurs when individual engages in some activity reflects upon the activities, critically drive some useful insight from analysis and incorporates the result through a change in understanding and the behavior. This type of approach helps students to apply their knowledge in real life situations and help them to come with viable answers.

Taking all these into consideration, in NEP 2020, more importance is given to change the teaching strategies and to use innovative methods or approaches like Ecological Approach which includes experiential learning, activity-based learning, project method etc which will result in a holistic development of learners especially in a subject like science. Teaching through ecological approach provides opportunities to the students to apply scientific concepts and reasoning to real life problems. It also helps students to develop social skills by creating content for interactions. In addition to improve academic performance and to cultivate more positive environmental behaviors, ecological approach has been found to lead to greater



motivation towards learning and to improve self-esteem. The analysis on science education researches clearly indicates the need for identification of certain priority areas which can contribute significantly to the development of various innovative curricula in science and allied disciplines. While laying stress on science education and science achievement, the National Policy on Education- 2020, recommended that Science Education will be strengthened so as to develop in the child well-defined abilities and values such as spirit of inquiry, creativity, objectivity, the courage to question and aesthetic sensibility. Science Education programmes should be designed to enable the learner to acquire problem solving and decision-making skills and to discover the relationship of science with health, agriculture, industry and other aspects of daily life.

The emerging vision of an education in science is that science and technology should be brought into the real life of the student. This all can become possible when a congenial, conducive and favourable classroom climate will be provided to students so that they can take science as a fun, experience providing subject rather than a boring or difficult one, which will result in connecting them with environment as Children are curious about how the world works, so high school stage is the time to give them a solid grounding in ecological principles. Students at high school stage start thinking critically to explore the bigger world around them, so what better time to give them a solid grounding in the laws of the universe and the principles of ecology — in short, ecological literacy and consciousness. Due to all these, Ecological approach is used in the present study for science teaching.

Ecological Approach and Science

The ecological approach to education views teaching and learning as processes situated within complex, dynamic, and interrelated systems. Derived from ecological and systems theories, this approach emphasizes the interactions among learners, teachers, curriculum, school environment, community, and the broader socio-cultural and natural context (Bronfenbrenner, 1979; Odum & Barrett, 2005). Science teaching, by its very nature, is closely aligned with ecological thinking because science seeks to explain relationships, patterns, and processes within natural systems. Understanding the relationship between the ecological approach and science teaching is therefore essential for developing meaningful, contextual, and sustainable science education.



Science teaching from an ecological perspective emphasizes interconnectedness, systems thinking, and contextual learning. Rather than presenting scientific concepts as isolated facts, the ecological approach encourages students to understand relationships among scientific phenomena, such as interactions within ecosystems, energy transfer, and human–environment relationships (Capra, 2007). This perspective supports inquiry-based and experiential learning methods, where students actively engage with scientific problems situated in real-life contexts. Fieldwork, experiments, project-based learning, and community investigations enable learners to interact directly with their environment, reflecting the ecological principle that knowledge emerges through interaction with context (Odum & Barrett, 2005).

Review of literature

A review of the literature is an essential part of any research. The review is a careful examination of a body of literature pointing towards the answer to researcher's question. To accomplish review of literature for the present research work, an extensive and thorough study was done to locate, read and evaluate research documents, reports, newspapers, magazines as well as thesis and other sources of academic materials available on-line and in print. The entire literature related to the subject in question was searched using different types of approaches, e-resources, also various books, periodicals, dissertation, conference proceedings etc. were scanned with a view to find out similar works in the field. These sources were scanned to help narrow down the problems encountered as well as strict a new line of approach to the existing problems. However, this investigator could not glean much information on the problem in hand, especially on the subject of the effect of ecological approach to teaching of science. The present study aims at exploring the Effect of Ecological Approach on Achievement in Science.

Sharma and Soni (2016) conducted a study entitled the Effect of Ecological Approach to Mathematics on Environmental Ethics and Achievement in Mathematics in relation to Parental Involvement. The purpose of the study was to determine how the Ecological Approach to Mathematics affected student's Achievement in Math and Environmental Ethics in relation to Parental Involvement. The experimental approach was used in the current study on a sample of 160 children from Shivalik Public Schools affiliated with the CBSE in Mohali, Phase 6, using a PreTest and Post-Test design. ANOVA was used in conjunction with factororial designs. The findings of this study show that the Ecological Approach has been proven to be a valuable



tool for improving children Math skills. Students who learned Mathematics using an Ecological Approach performed better than those who learned it using a conventional technique. Additionally, it was shown that pupils become persistent and driven in their studies. The Achievement of students was enhanced with the use of this Ecological Approach. Similarly, Binning, Kaufmann and McGreevy (2020), Chennamsetty and Suneetha (2020), Daniel et al. (2021), emphasizes the use of Ecological principles as an evaluation tool in environmental education. Son and Berdychevsky (2022), Jimenez et al. (2023) viewed Ecological approach as a crucial component of a single educational process that includes all student age groups, imparts pertinent knowledge about the interactions between nature and society and fosters a responsible attitude toward the environment. McCrone and Kingsbury (2024), Syarofah et al. (2024) in their study explored that ecological approach provides more contextual and relevant learning experiences for students. Hancock (2025), Susanto et al. (2025) inferred the viability of an Ecological Approach to fostering equity and unlocking student potential. Li et al. (2026) in their study aimed to develop a competency-oriented ecological education model and evaluated the feasibility and preliminary outcomes of its implementation for enhancing evidence-based practice competencies among undergraduate nursing students. Sibanda and Masinga (2026) in their study found that there are myriad contributory factors that have been identified as accounting for the prevalence of violence in South African schools. The study concluded that the measures to be put in place to address school-based violence should target the individual, family, community, and broader societal causes of violence.

Based on the literature discussed, it is possible to conclude that ecological approaches to conceptualising educational spaces and educational research can reorient learning and teaching towards values rooted in our connection as human beings and our relationships with the world. It provided direct experience through social and cultural context about natural surroundings and relationship among environment and man which will result in higher Academic Achievement of students.

RESEARCH GAP

The existing system of education is largely confined to knowledge transmission, while the need of the day is for students to learn and acquire wisdom to use knowledge for their own growth, character building and contributing to society. This view has been supported by the Delor's



Report (1972) which emphasizes that education must contribute to social and economic development 'as also to bring out the treasure within the human beings' and it can also be seen as a system for gainful employment resulting in sidelining the development of a holistic personality. There is an urgency to reorient out existing teaching methods from 'chalk and talk' and lecture methods to problem-solving methods, from activity and issue-based approach to field work and case studies, from didactic to advise-based approach, and from rote learning to attitudes and skills development and learning through participation and educational training in order to deepen the experience and involvement with the natural surroundings.

The review of related studies reflected that there is need to use different instructional approaches to enhance the achievement of the students. The outdated and rigid curricula and the poor teaching methods have resulted in students who are lacking various skills like critical thinking, analytical reasoning, problem-solving and collaborative working with low employability limiting movement to higher levels of study and research. With this ecological approach, students will learn to look at science as a whole, rather than piecemeal. Also, they will come to know that how the different scientific concepts are connected to each other and to the real world. In science teaching with ecological approach means helping students staying connected with the rest of nature. It includes a rich variety of interactive practices where by participants have opportunities to learn from their own and others experiences. Use of ecological approach in the present study aims at unlocking human potential within the classroom settings. Through this, teachers will improve their practice, students will gain from an important paradigm shift in education, and ultimately society will be the greatest beneficiary. The present study is expected to make a significant contribution in the approach to teaching and instructional design in the science. The study will give implications for developing lesson plans and teaching instructions in context of social relevance. This will help in improving the achievement, Environmental Responsible Behaviour and the entrepreneurial attitude of government high school students so as to provide them quality education which is the need of the hour in today 's competitive world.

Above discussion reveals that the use of Ecological Approach in teaching of science can result in development of Environmental Responsible Behaviour, Entrepreneurial attitude in students and help them in improving their Achievement in science. The studies show positive results in



teaching learning process, so such approaches should be followed in schools. As not much research work has been done on the proposed topic in Government High and secondary schools of Chandigarh, Investigator did not find any study conducted on the school students of Chandigarh on the proposed topic. As the investigator did not find any study conducted which investigate the effect of Ecological Approach on achievement in Science, Environmental Responsible Behaviour and Entrepreneurial attitude among secondary school students, the proposed study thus seems fully justified and mostly the studies coded on Ecological Approach, Environmental Responsible Behaviour and Entrepreneurial attitude supports the proposed topic towards further research.

STATEMENT OF THE PROBLEM

Effect of Ecological Approach in Science Learning on Secondary School Students' Achievement

OBJECTIVES OF THE STUDY

Major objectives

1. To study the perception about science learning among secondary school students.
2. To compare the effect of instructional program (Ecological approach and Conventional approach) in science learning on achievement of secondary school students in control and experimental group.
3. To compare the perception about science learning among secondary school students with respect to gender.
4. To compare the perception about Ecological Approach among secondary school students with respect to gender.

HYPOTHESES

- H01 There will be no significant difference on achievement of secondary school students in the control and experimental groups due to instructional program (Ecological approach and Conventional approach) in science learning.
- H02 There will be no significant difference in perception about science learning among secondary school students with respect to gender.
- H03 There will be no significant difference in perception about Ecological Approach among secondary school students with respect to gender.



Design of the Study

In the present study Non-randomized Control Group Pre-test-Post-test design (Koul, 2011) also known as non-equivalent pre-test and post-test design was used. It was preceded by a qualitative phase which includes a preliminary survey involving interviews to know perception of govt. secondary school students in Chandigarh Capital Region about science learning i.e. what they think about science subject, what is their classroom environment in science teaching, how their educator teach them etc followed by quantitative phase which includes pre-test instructional program-post-test followed by a feedback regarding their perception about Ecological Approach.

Sample: Population of the sample were the students of class 10 studying in C.B.S.E affiliated government schools of Chandigarh region. Sample was selected by multi stage random sampling method. 95 students were selected each for control and experimental group. In total, 190 students were selected as sample of the study.

PROCEDURE OF THE EXPERIMENT

From the prescribed syllabus of class 10 by C.B.S.E topics were taught in the instructional program to the control group (by conventional method) and the experimental group. Instructional program includes development of lesson plans prepared by researcher (by Ecological Approach) in which 40-45 teaching sessions around 3-4 months were done, each sessions of 40-45 minutes. During each session, one topic from syllabus was taught using various activities, experiments, trip to fields, parks, laboratories i. e. using real materials, substances and taking students to real situation or natural environment so as to connect school life with real and outside life. For example, concept of magnet, magnetic fields, motor was taught by using real magnets, iron fillings, wood fodder etc to show formation of magnetic field and lines. Similarly, topic of natural resources was taught by taking students to botanical garden, zoo, sewage treatment plant, showing water harvesting projects like dams etc.

TOOLS TO BE USED The following tools were used to collect data:

- Questionnaire cum interview prepared by the researcher to know perception of students about science learning.
- Instructional material and lesson plans were prepared on the basis of conventional and ecological approach.

- Achievement Test of science for class 10 students on above tentative topics was developed and validated by the researcher.
- Feedback Performa to know perception of students about ecological approach.

STATISTICAL TECHNIQUES After completion of the instructional program, the scores were put to statistical analysis. Following tests will be administered to draw the conclusion.

- Descriptive statistics such as mean, standard deviation, skewness, and kurtosis will be used to ascertain the nature of the distribution of scores.
- Graphical statistics will be used for the visual representation of the data.
- T-ratio will be used to assess the difference in the mean scores of the variables.
- Feedback form for students to know their perception about Ecological approach.

DATA ANALYSIS

The data analysis for the present research was done to fulfil the objectives and test the hypothesis by using quantitative as well as qualitative methods. The statistical techniques like mean, standard deviation and t-test were used. The data obtained from the experiment was subjected to preliminary analysis, descriptive as well as suitable inferential statistics. Keeping in mind the problem, objectives and the hypotheses, following subheadings were formed and the obtained data was processed, analyzed and interpreted accordingly.

Preliminary Analysis: In the preliminary analysis, first step done was P-P plots. In statistics, a P-P plot (probability-probability plot or percent-percent plot or P value plot) is a probability plot for assessing how closely two data sets agree, which plots the two cumulative distribution functions against each other. P-P plots are vastly used to evaluate the skewness of a distribution. Normal probability plots provide a quick way to visually inspect to what extent the pattern of data follows a normal distribution. Here we considered only P-P plots for all scores and is represented in following figures.

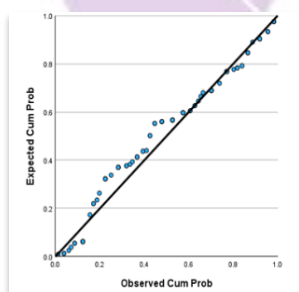


Fig 1

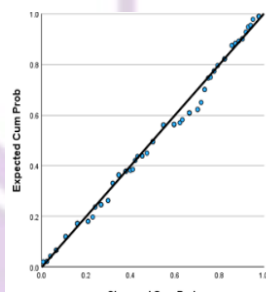


Figure 2

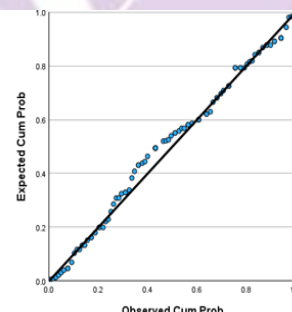


Figure 3

P-P plots for Pre test scores P-P plots for Post test scores P-P plots for mean gain scores

Figures 1,2 and 3 showing normal P-P plots for pre, post and gain scores of science achievement test (Control group).

Figures 1,2 and 3 depict normal P-P plots for pre, post and gain scores of achievement. The plot shows that all points are closed to the diagonal at high as well low end in pre, post as well as for gain score of achievement, how but there is little variation at the middle of line where some points are short off the diagonal. These variation of points are not too far from diagonal line and considered to be outlier in case of adjustment, but we ignored these variation and pre assumed for analysis point that data are normal. This mean there is no need as such any corrections /modifications or any types of alteration in the data.

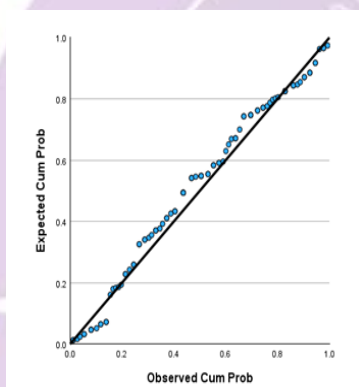


Figure 4

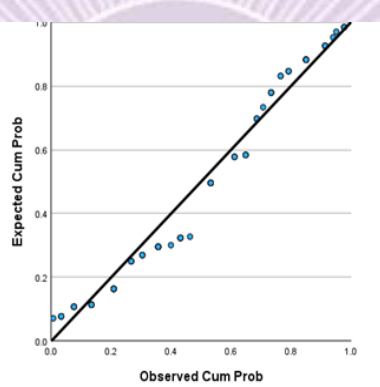


Figure 5

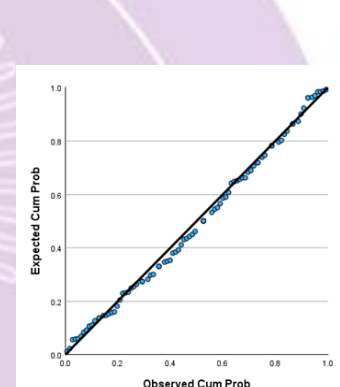


Figure 6

P-P plots for Pre test scores P-P plots for Post test scores P-P plots for mean gain scores
Figures 4,5 and 6 showing normal P-P plots for pre, post and gain scores of science achievement test (Experimental group).

Figures 4,5 and 6 depict normal P-P plots for pre, post and gain scores of science achievement test of experimental group. The plot shows that all points are closed to the diagonal at high as well low end in pre, post as well as for gain score of achievement, however, some points are short off the diagonal at the middle of line. These variation of points are not too far from diagonal line and considered to be outlier in case of adjustment. These variations were ignored and the data was pre assumed to be normal for analysis.

DESCRIPTIVE ANALYSIS: This section deals with descriptive statistics of achievement in science of the students in which mean, S.D, Skewness, Kurtosis, minimum and maximum of



achievement scores in science of pre test, post test as well as mean gain scores of the students were calculated to ascertain the normal distribution.

Table 1: Mean, S.D'S, Skewness, Kurtosis, Minimum and Maximum of pre achievement score, post achievement score, and gain achievement score in science of control group students

Test Scores	Pre test	Post test	Mean gain scores
N	95	95	95
Minimum	10	21	1
Maximum	27	40	25
Mean	17.51	27.47	9.94
Std. Deviation	4.16	5.18	4.97
Skewness	-0.094	0.950	0.452
Std. Error of Skewness	0.247	0.247	0.247
Kurtosis	-0.914	0.052	-0.448
Std. Error of Kurtosis	0.490	0.490	0.490

Table 1 shows the descriptive statistics of pre, post and gain scores of achievement in science of students. The values of skewness for pre test is negative and thus the distribution for pre test is negatively skewed whereas the distribution is positively skewed for post test and mean gain scores and is less than ± 1 . These values are within the acceptable limit of normality and may be acceptable as having skewness of moderate degree. Also the values of Kurtosis indicate that the distribution of pre, post and gain score of achievement is approximated to normal distribution and the curve for pre and mean gain achievement scores was platykurtic whereas in the case of post test achievement scores it was leptokurtic.



Table 2: Mean, S.D'S, Skewness, Kurtosis, Minimum and Maximum of pre achievement score, post achievement score, and gain achievement score in science of Experimental group students

Test Scores	Pre test	Post test	Mean gain scores
N	95	95	95
Minimum	9	32	9
Maximum	28	48	37
Mean	17.98	39.05	21.74
Std. Deviation	4.79	3.87	5.74
Skewness	0.036	0.239	0.228
Std. Error of Skewness	0.247	0.247	0.247
Kurtosis	-0.798	-0.366	-0.260
Std. Error of Kurtosis	0.490	0.490	0.490

Table 2 shows the descriptive statistics of pre, post and gain scores of achievement in science of experimental group students. The values of skewness for all the cases are positive and thus the distribution is positively skewed and is less than ± 1 . These values are within the acceptable limit of normality and may be acceptable as having skewness of moderate degree. Also the values of Kurtosis indicate that the distribution of pre, post and gain score of achievement is approximated to normal distribution and the curve for all the cases are platykurtic.

Testing of Hypothesis: In this section, "t-test" was employed in order to find out the significant difference in mean gain scores for Achievement test in Science of the students.

(I) Testing of Hypothesis related to Achievement in Science: H01 There will be no significant difference on achievement of secondary school students in the control and experimental groups due to instructional program (Ecological approach and Conventional approach) in science learning.

To find out the mean gain scores of Achievement test in science by control and experimental group students, the difference of the post-test and pre-test was obtained of both the groups.

The mean, standard deviation, standard error of deviation, mean difference, standard error of mean difference and t-ratio were calculated as shown in table 3

Table 3 showing the mean, standard deviation, standard error of deviation, mean difference, standard error of mean difference and t-ratio of Science achievement test for control and experimental groups.

Groups	N	Mean	S.D.	S.E.D	Mean Difference	S.E. M.D.	Df	t-ratio	Remarks
Control	95	9.94	4.97	0.49	11.12	0.65	94	17.11	Significant at 0.05 level
Experimental	95	21.74	5.74						

Table 3 reveals that mean scores for experimental group was more i.e.21.74 as compared to that of control group i.e. 9.94. The obtained t-ratio value was 17.11 which was significant at 0.05 level. The groups with different instructional approaches differed significantly on the mean gain scores and t-ratio in the achievement test in science.

Hence, the hypothesis H_{01} that “There will be no significant difference in achievement of secondary school students in the control and experimental groups due to instructional program (Ecological approach and Conventional approach) in science learning” has not been retained and thus rejected. The students taught by Ecological approach exhibited better performance and achievement in science as compared to those taught by conventional approach.

Additionally, the category wise analysis of the mean scores obtained by the experimental group students at Science Achievement pre and post tests stage was done in order to understand the in-depth effect of Ecological approach.

Table 4: Category wise analysis of the mean scores of experimental group.

Test	Knowledge	Understanding	Application
Pre test	6.20	7.07	4.70
Post test	13.93	16.81	8.30
Difference	7.73	9.74	3.60

Table 4 reveals that mean score is more in post-test in all the categories of the skills. However, the difference in the mean score was highest in the category of understanding (9.74), followed

by knowledge (7.73) and application (3.60). It may be inferred that the Ecological approach resulted in better performance in understanding level of students.

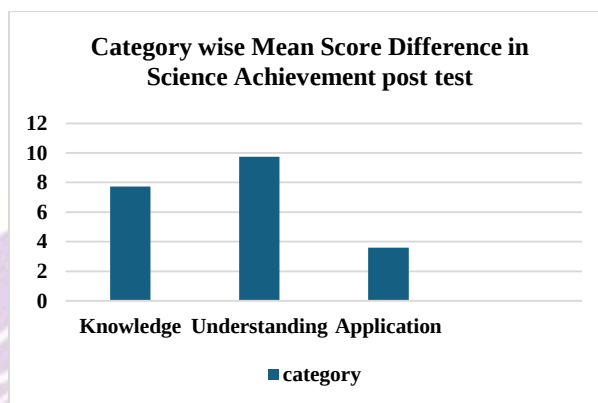


Figure 7 Graphical representation of category wise mean gain scores difference of Achievement test in Science

From the above figure, it was found that understanding dimension of the tool have more mean gain scores as compared to other dimensions of the experimental group students and thus it can be inferred that ecological approach resulted in better understanding of scientific concepts by students.

This finding is in accordance with the research findings of Sharma & Khatoon (2011) reported that the students involved in different activities (i.e. sports, computer and internet related activities) yielded better science performance. Webb (2011) reported that there are several significant associations between the individual's ecology of human development and their academic achievement in a homogenous ability grouped mathematics class. The ecological approach, when aligned with contemporary educational philosophies, encourages the use of diverse resources and active learning, rather than traditional, teacher-centered methods. Models within this approach employ the environment as a laboratory where students gather, analyze, and apply data, enhancing student engagement. Gilavand (2016) in a study whose aim is to investigate the impact of environmental factors (schools' open space, noise, lighting and paintings in educational institutions) on learning and academic achievement of elementary students, found that environmental factors (appropriate coloring, lighting of educational environment and schools' open space) has impact on learning and academic achievement of elementary school students. Park (2020) has done a descriptive, mixed methods study and investigated learning outcomes and processes of integrating environmental education (EE) and



science education (SE). Specifically, this study examined the impact of EE-based constructivist science teaching approach on students' science achievement scores, environmental self-efficacy, course completion rate, and perceptions of their learning experiences. Data analysis indicated that students with an EE-based constructivist science teaching approach performed higher on science achievement tests and developed statistically higher environmental self-efficacy than those in a traditional teaching classroom.

Susilawati (2022) explored students' attitudes toward science learning based on gender and the grade level of schools in Aceh, Indonesia. Based on gender, the results show females reflect more positive attitudes toward science than male students do. According to the grade level of the schools, the data reflect the equality of students' attitudes toward science between primary and secondary schools. Barakat (2024) also found the effectiveness of an environmental approach-based learning method in developing primary science process skills and enhancing cognitive achievement among children. The results indicated that the experimental group achieved significantly higher scores on both the science process skills test and the achievement test compared to the control group. All of the above studies also revealed that Ecological approach enhances achievement of students.

Testing of Hypothesis related to perception about Science Learning

H02 There will be no significant difference in perception about science learning among secondary school students with respect to gender.

Table 5 showing the mean, standard deviation, standard error of deviation, mean difference, standard error of mean difference and t-ratio of perception of boys and girls about science learning.

Groups	N	Mean	S.D.	S.E.D	Mean Difference	S.E.M.D.	df	t-ratio	Remarks
Boys	49	9.00	4.64	1.39	-2.26	0.995	45	2.267	Significant at 0.05 level
Girls	45	11.24	5.74						

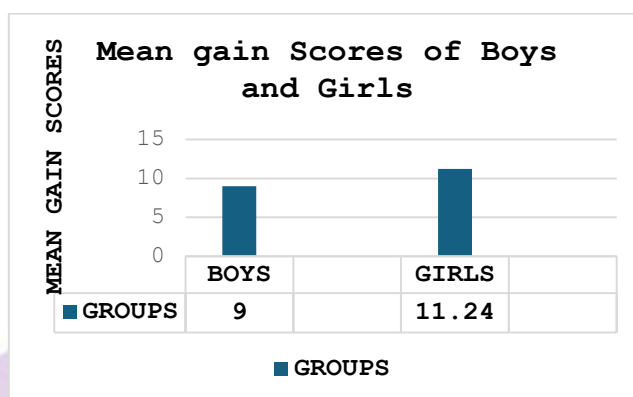


Figure 8 Graphical representation of mean gain scores of Boys and Girls.

Table 5 and figure 8 reveals that mean scores of girls was more i.e. 11.24 as compared to that of boys group i.e. 9.00. The obtained t-ratio value was 2.267 which was significant at 0.05 level. This shows that the two groups significantly on the mean gain scores and t-ratio in their perception about science learning.

Secondly, during the preliminary interview cum questionnaire, 60% girls and only 34% boys showed interest in science. They found science interesting and enjoy to do experiments and were able to relate it to real life. On the other hand, majority of boys i.e. almost 60%, and few percent of girls found science as a phobia, difficult and a burdened subject. Rest were neutral about science as they have opinion they have it as a subject and have to do it.

From all of the above analysis and findings, it was inferred that girls have more interest in science learning than boys. Hence, the hypothesis H₀₄ that “There will be no significant difference in perception about science learning among secondary school students with respect to gender” have not been retained and thus rejected.

Testing of Hypothesis related to perception about Ecological Approach

H₀₃ There will be no significant difference in perception about Ecological Approach among secondary school students with respect to gender.

Both the groups i.e. boys and girls were taught through Ecological Approach. Mean of boys and girls in pre and post test of various tools various tools were calculated as shown in the table

Table 6 showing mean scores of Boys and Girls

	Achievement Test		ERB Test		EAOS	
	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS
Pre Test	18.38	17.54	79.44	77.04	75.34	75.52
Post Test	38.77	39.34	146.44	145.80	108.54	106.86
Mean Scores	20.38	21.80	66.67	68.97	67.0	68.65

Table 7 showing the mean, standard deviation, standard error of deviation, mean difference, standard error of mean difference and t-ratio of perception of boys and girls about Ecological Approach.

Groups	N	Mean	S.D.	S.E.D	Mean Difference	S.E.M.D.	df	t-ratio	Remarks
Boys	49	21.12	5.97	0.85	0.39	0.85	45	-1.54	Not Significant at 0.05 level
Girls	45	22.89	5.09						

Table 6 and 7 reveals that the mean of girls 22.89 is not much more than that of boys i.e. 21.12., also the t ratio value i.e. -1.54 is not significant at 0.05 level. This conclude that boys and girls both have same perception about Ecological approach.

Secondly, the responses of the feedback pro forma also revealed that almost 97.8% boys and girls found Ecological Approach interesting and helped them to improve their science learning. ERB and EAOS.

As the difference in mean scores and t ratio was not found significant, so, **the Hypothesis H05 “There will be no significant difference in perception about Ecological Approach among secondary school students with respect to gender”** has been retained.

ANALYSIS OF FEEDBACK PRO FORMA:

After the treatment, a feedback proforma was given to the experimental group regarding the effectiveness of teaching through ecological approach. It includes statements regarding methodology and activities conducted during the experiment. From responses. It was inferred



that all the students agreed that Ecological Approach stimulated their interest in Science; they enjoyed all the visits, experiments, activities, group projects etc done throughout the programme. They all also appreciated the use of natural and real objects for teaching different topics and their participation in different activities in a threat free environment. 97% students appreciated experimental activities, group activities, collecting examples from natural settings and its surroundings. 95% preferred the integration of theoretical concepts with real-world applications. It reflects that ecological approach infuses interest in science and also resulted in positive change in students behaviour towards environment and also in their entrepreneurial attitude. Use of different group activities, project making promoted the management, leadership, coopertaion like qualities in students. Also, the students cherished the new way of learning. The concepts were vivid after following this methodology. In total, this was inferred from the above that Ecological approach improved the science learning of the secondary school students.

CONCLUSION OF THE STUDY:

The ecological approach used in this study can be traced back to the work of Bronfenbrenner, Vygotsky and Dewey. Based on the ecological model of Bronfenbrenner (1979), the child is centrally positioned within a series of interconnecting environmental systems. The findings of the study revealed that ecological approach has positive effect on the achievement in science of class 10 students of government school of Chandigarh region. Ecological approach has been found to be a useful tool for enhancing the performance of the students in science. Students taught science by ecological approach scored better than the students taught by traditional method. Also, it is found that students got motivated and became persistent in their learning process. This approach is helpful in motivating students for bringing new ideas of learning in threat free environment. It is also helpful in enhancing their interest in learning by active participation in learning process. Students themselves start taking initiatives when they are given freedom by altering classroom environment and building rapport. They actively participate in the classroom in different activities. Teachers should use ecological approach to the maximum to teach science in lower classes in order to create interest and remove fear of science, as it is crucial age when they develop habits, values and attitudes. It should be used for other subjects too. Teachers should also make parents aware about this approach through



parents-teacher meetings and seminars to gain their support while implementing strategies under ecological approach. So, ecological approach should be used maximally in our teaching-learning process. As nature itself is considered to be the children's best teacher. So, there is a need to allow children's exposure to the nature. The more personal students' experience with nature, the more environmentally concerned and active children are likely to become. So, in order to result in desirable behavior of the children, ecological approach must be adopted. Thus, the ecological perspective is based on the understanding that the student and the learning environment mutually interact, learning is interactive and happens in relevant contexts only. But presently there is disconnect between the classroom learning and the real life due to over emphasis on achievement that takes away the joy of learning and its application in real situation. Educationists have been suggesting integration of classroom learning with real life. So, there is a dire need of changing the process of teaching in order to improve the learning process. Teachers need to combine the surroundings, real life examples and understand the concept of ecological approach to strengthen their teaching. This approach needs to be applied in teaching and learning science from the basic level so that the kids become well versed with basic concepts.

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