

Emerging Trends in Science Teaching–Learning Beyond Classroom: Feasibility and Process

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Abstract

In the present study, the researcher used the method of survey to focus on the present teaching method followed in the schools of neighbourhood and also reviewed some of the research literature related to science teaching out of the classroom as one of the innovative and effective methods of teaching science which can be practised in secondary school level to enhance quality in science teaching–learning process. And the researcher planned a strategy to follow this method to teach science. Using only traditional method like chalk and talk method, lecture method will not be effective in teaching science. Teaching science beyond the classroom is effective method of teaching to attain the objectives of teaching science. And the researcher found that teaching beyond the classroom following the strategy planned by the researcher is one of the effective methods of teaching science in secondary school to achieve objectives of teaching science.

Keywords: Learning science, outdoor teaching, secondary school, outdoor teaching strategy, thinking ability

INTRODUCTION

We are living in the era of science and technology and science is a subject which is base for this development. Science is a subject which inculcates a system of discipline among the learner and will help to develop creativity, scientific attitude, problem solving skill, and thinking ability which will help the learner to solve the real-life problems in future and to lead life well. Understanding the world in which we live can be achieved through the study of science. It also makes us understand the contributions of scientist and their hard work behind the present life we are living.

Science is a subject which gives basic ideas to solve so many problems related to betterment of the society. If science as a subject is taught by satisfying its objectives inside the classroom, by following

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the process, aspect of science as how scientist followed to accumulate this corpus amount of knowledge, then without any difficulty, objectives can be achieved as a learning outcome among the pupil. But inside the classroom, execution of curriculum is still using old method of chalk and talk method, or lecture demonstration method. So, many reforms are made in the curriculum and methods of teaching. Yearly, so many trainings are given to the teachers about innovative teaching methodology to make teaching learning process active and effective, but still, inside the classroom when the plan is executed still teacher dominates

the classroom and students are passive listeners. We are talking about quality education but importance is given to quantity of marks scored in exams.

In the present study, the researcher used the method of survey to focus on the present teaching method followed in the schools of neighbourhood and also reviewed some of the research literature related to science teaching out of the classroom as one of the innovative and effective methods of teaching science can be practised in secondary school level to enhance quality in science teaching–learning process. And the researcher planned a strategy to follow this method to teach science.

THE PRESENT STATUS OF SCIENCE TEACHING AS OBSERVED BY THE RESEARCHER

In the present study, the researcher being herself is a secondary school teacher teaching science since 15 years and follows a method of teaching which is prevalent in schools in and around city. And it is the general practice of teaching that is followed in the majority of the schools where professional colleagues work.

In every walk of our life, we depend on science and technology but still most of our schools follow traditional method to teach science. In traditional method of science instruction, content flows through a teacher. Knowing the previous knowledge of the learner, teacher accumulates the information as learning points based on the text book. Then teacher executes the content by explaining it using lecture method without giving any hands on real experiences. The practical oriented experienced based Science subject and its learning points are presented to the learner by only giving oral explanation. The teacher displays, explains, and models the material, and the student simply watches and absorbs it. The student is only required to recollect, repeat, or summarise the material on the basis of understanding what is verbally explained to them. Students are forced to study practical oriented concepts only as theory and write it out during the exam. Students play a role of passive listeners and they learn and follow blindly without any hands-on experiences and practical knowledge and also accepting things without any expression of their own creative thinking and ideas. That is the rote recall method traditionally been geared around.

In the present scenario, in traditional methods of teaching science in classrooms are mainly focused on by hearting the concepts. Using chalk and talk method, the science concepts are just as a statement taught to the student. Science principles, laws, theories without giving any hands-on experience as content is just loaded in to the minds of the pupil.

In the traditional method of teaching science, the practical oriented subject is taught in a way only by displaying and explaining two dimensional charts and images. And also, by using dummy models, which will only give outer look, which is more or less equivalent to image. Where learners will not get any idea about working, functions and implications of the concept. The science concepts like structure and functions of human body organs are taught by showing models and explaining it, which will not create any real idea about structure and function of body parts in the minds of the learner. This traditional method of teaching in any way will not contribute to the very important aspect of teaching science that is none other than the process aspect of teaching science. Science teaching aims not only at the product but also process aspect of teaching. Which is very essential to develop science process skills among the learner.

Science concepts like ecosystem, biodiversity, agriculture, environment and environmental pollution etc., are directly related with life of the pupil to conserve environment in future. Such beautiful and life related concepts are taught inside the four walls of a classroom just giving examples of biotic components with oral explanation and also about the interrelationship of these components,

which will not give any insight into the reality about the nature of the environment and its functioning and the importance of each biotic and abiotic component in environment conservation. In usual traditional method of teaching science concepts like farming is explained by showing images of process of farming and instruments used in farming. If these practical oriented concepts are taught in such a way, then how students will get practical knowledge of the concept to implement it in their daily life to become self-sustainable in future and also how the learner will inculcate the value of respecting food and not to waste food.

By using traditional method, the practical oriented subject is presented to the student in such a way that the focus is only given to write exam and score good marks. There is no scope to gain real objectives of teaching science. Still in our science classrooms, students are passive listeners and they only observers and they do not have opportunity to explore the world, which makes them only to score good marks but they do not get any practical experience and also, they are not able to relate what they learned in the classrooms directly to their life in future.

In this method of teaching science, teacher directs students to learn through memorization and recitation techniques without giving scope to develop their critical thinking, problem solving and decision-making skills. Traditional teaching is a teacher-centred approach to transfer knowledge. Teacher imparts knowledge of science as a packets of concepts, facts, principles and theories without making them understand the basic working principle behind each concept, fact, principles and theory and its implication to daily life situation. In this method, the teacher teaches science as an isolated subject without connecting any of its simple factors to learner's daily life which is very important aspect of science teaching.

The students are only required to reproduce knowledge and memorise it; in this situation, the teacher's opinion predominates. The methods here are often teacher-directed, and instruction is conducted in a way that encourages pupils to sit still and listen. If we look in to the present secondary school level science curriculum, it contains concepts which need hands on experience and demonstration, there is a lot of scope for outdoor teaching which will relate knowledge to real life situation and learning will become joyful and meaningful. It is also significant that secondary school level is a stage in every one's life to lay foundation for their future professional life.

The present secondary school level science curriculum contains concepts like natural hazards like lightening, thunder and fire explosion: reasons and its preventive measures; farming, environment conservation measures, pollution: reason and preventive measures; microorganism: uses and harmful effects of it. Force, friction, light: its implication in daily life. All these real life related concepts are just explained orally without giving any outdoor experience hands on experience and demonstration where there is a scope in outdoor a lot which will make science teaching a real and meaningful learning.

Hence teaching life related concepts in science through outdoor will be more effective. Here researcher herself being a science teacher taught some of the concepts following outdoor teaching as a pilot study for the 8th standard students of Government High school (Urdu), Bunder, Mangalore, of academic year 2021–22. And researcher found tremendous changes in the scores of achievement in science and students who were able to answer on their own the application level questions and also it had contributed a lot towards the development of interest towards science subject and also improved scientific attitude of students. So, researcher strongly believes in outdoor science teaching.

The present secondary school level science curriculum contains concepts like natural hazard like lightening, thunder and fire explosion and its preventive measures, farming, environment conservation measures, pollution, its reason and preventive measures, microorganism and harmful effects of it,

force, friction, light and its implication in daily life. But these life related concepts are just explained orally without giving any outdoor experience hands on experience and demonstration where there is a scope in outdoor a lot which will make science teaching a real and meaningful learning.

FINDING WAY OUT TO IMPROVE UPON THE SITUATION

How students are taught has a big impact on what they learn. Teachers' perceptions of science as an endeavour and a subject to be taught and learned have a significant impact on how they behave. As scientists look for answers to questions about the natural world, they gain knowledge and understanding. As students actively participate in scientific enquiry, both alone and with others, they grow in their understanding of the natural world.

Several teaching and learning models that are pertinent to the teaching of science in the classroom have been produced by educators over time. All the process and freedom in teaching can be provided in the teaching learning process by following the strategy of science teaching outdoor. Here each concept is taught using a strategy where learner is exposed to the real world of experience by exposing them to the real practical knowledge through demonstration by the real experts in the field or by the teacher herself. For example, the concept of farming is taught using outdoor strategy in such a way that students as a group are taken out to outdoor to the real farming field where students are exposed to the real farming procedures step by step and also given real hands on experience to practically grow crops. And students become so able that they are independently able to grow plants. By doing so, they will realize the real effort and difficulty the farmers face in farming and in food production. To explain with another example, while teaching concept of usefulness of microorganism and pasteurization using outdoor strategy, students are taken outdoor to milk dairy where students are exposed to the real process of pasteurization and also different processes followed in dairy farm. Students by looking into the facility, comfort, technology and responsibility of the employees may get insight into its working and also some of them will be inspired to show interest to continue their education and join into that organization. To continue with while teaching concepts like stars and satellites, learners are taken out to outdoor to Planetarium to get the real experience of space, so that they will get insight into the abstract concept of stars and universe. And also, learner will be inspired to be future scientist. While teaching the concept of environment and its conservation also, students are taken out to the outdoor to park, zoo and also for a nature walk to identify and understand different biotic and abiotic components of the environment and its interdependence in natural setting so that students will understand the importance of each component in the environment and its importance in balancing and conserving environment. In this way in outdoor teaching strategy, concepts are taught entirely in the outdoor setting giving real experience so that students will learn science concepts, learning science process skill, interacting with environment and also with their peer group they will learn social skill which is very essential as a responsible citizens. Using an outdoor technique to teach children acquire the skills of interpersonal communication, problem solving, and healthy relationship-building. By allowing children the freedom to freely explore, learn, and think, it lowers communication barriers.

Experiential education is active education that takes place outside. Participants in outdoor learning gain knowledge by their actions, their experiences, and their discoveries. Together with gaining outdoor skills, participants gain new insights into the environment, themselves, and other participants. Students take part in games, hikes, rock climbing, and other outdoor activities as part of the outdoor education programme.

By giving kids opportunities for physical activity, independence, and movement, learning outside the classroom helps the development of healthy and active lives and fosters a sense of wellbeing in children. Studying outside of the classroom encourages and provides chances for children to interact

with the natural world. It also provides them with experiences that are only available outside, like close encounters with the weather and the seasons. With chances for physical activity, freedom of mobility, and the promotion of wellbeing, learning outside the classroom aids in the development of healthy and active lifestyles in children. Children learn about and acquire a respect for nature, as well as the interdependence of humans, plants, and animals, as they play and learn outside. Children's ability to solve problems and foster their creativity is aided by outdoor education, which also offers several possibilities to foster the growth of creativity, imagination, and resourcefulness.

Children need access to the outdoors to learn, play, explore, be physically active and healthy, and to grow physically. The outdoor setting provides room, making it especially crucial for kids who learn best via movement. The most effective use of resources is learning that easily transitions from indoor to outdoor settings, which also increases interest and passion.

Though outdoor teaching has got so many advantages over the learning process but still we follow the same old method to teach science. Because of this practice, the researcher has a worrying dissatisfaction and trying for long time for improving upon the situation that could entirely change the everyday science class. So, the attempt is made through the present study to develop a practical strategy that could lead her classes out of the way of the present traditionally dominant teaching learning process. For this the researcher first consulted some research literature which can help to understand the science teaching could cross the four walled science classes.

REVIEW OF LITERATURE

The study by Sozbilir based on the principle that teaching should be based on what pupils already know, or the golden rule of educational practise [1]. According to Farias *et al.*, outdoor play is crucial for encouraging youngsters to understand science in a meaningful way [2]. Ayotte-Beaudet *et al.* found that there is a positive correlation between students' preparation and their perception of learning during outdoor science lessons [3]. As a result of the interaction between outside stimuli and pre-existing beliefs in the learner's mind. Dettwiler *et al.* argued that outdoor educational settings, pupils show significantly higher learning motivational behaviour [4]. Festeu *et al.* suggested that outdoor non-formal learning has effectiveness in learning [5]. According to study from Francis *et al.*, students' connections to nature can be strengthened by having them explore their local environment as part of scientific lessons [6]. According to Rios and Brewer, research shows that outdoor learning opportunities foster a love of the environment and have a favourable impact on students' aptitude for science [7]. Maulina found that outdoor learning enables effective learning. Outdoor learning can be employed in place of traditional classroom instruction [8]. As a result, it is quite successful at honing problem-solving and scientific process skills, and found that outdoor learning engages students in activities and learning. For pupils who find classroom learning more difficult, outdoor education has been demonstrated to be more advantageous. Mapotse and Mashiloane, found that, the teachers in their study reported "that when engaged in child-initiated activity in the outdoor environment, over half of the children who in the classroom were perceived to be 'underachieving' appeared to behave differently" [9]. Their research intends to provide evidence for the idea that more natural outdoor settings, where child-initiated activities occur, both directly and indirectly lessen the impression of under-achievement. As a result of outdoor science activities using an interdisciplinary approach, teachers may find their disciplinary knowledge and skills improved, with the result that they are more able to answer research questions in real environments. Moreover, through theoretical and methodological interdisciplinary, teachers may foster the creation of new conceptual categories and methodological tools, using concepts or procedures from other disciplines in an auxiliary relationship. Eckhaus *et al.* found that from outdoor teaching perspective, interdisciplinary outdoor science activities have the potential to organise scientific topics and ideas and answer questions across different disciplines [10]. DeZure *et al.* proved that outdoor science teaching activities provide an

opportunity to develop problem-solving abilities, generally considered as an instance of higher order thinking within science courses [11]. Gnerrero and Reiss found that interdisciplinary outdoor science activities carried out appear to generate common work objective, addressing conceptual, procedural and attitudinal aspect across science subject [12]. de Escha *et al.* demonstrated that it is impossible to disregard the impact that events outside of the classroom have on students' knowledge, understandings, beliefs, attitudes, and motivation to learn [13]. Guerrero and Reiss found that Science is indeed generally hard to learn [14]. Nonetheless, students typically appear more enthusiastic when visiting or being taught in locations that explain science in frequently novel and fascinating ways. We think that there is something about these environments and situations that changes people's motivation to learn more. Also, there may be larger and deeper learning opportunities that do not necessarily present themselves during traditional indoor teaching. Student engagement is crucial for any learning, children were interested, involved and enthusiastic during outdoor activities and also children's obvious happiness and enjoyment may be considered indicative of their emotional engagement in the outdoor tasks. Thalib and Ahmad concluded that the activities of outdoor learning which are part of study field curricular area of environmental studies considers the local environment as a lived space and it should be privileged object of a systematic and methodical first learning of the child since, at these ages, the thinking is directed towards concrete learning [15]. It is also considered that it will contribute to the construction of scripts and didactic sequences of learning where the student centred active learning is valued. A significant and comprehensive review of outdoor learning was published in 2004 by Rickinson *et al.* from the National Foundation for Educational Research and King's College London in England [16].

This study “critically analysed 150 articles on outdoor learning research published in English between 1993 and 2003.”. Three kinds of outdoor learning were covered by their corpus: fieldwork and outdoor excursions, outdoor adventure education, and school grounds/community initiatives.

They stated that school grounds and community projects “have the potential to link with most curriculum areas”, that they might “include greater confidence, renewed pride in community, stronger motivation towards learning, and greater sense of belonging and responsibility”, all without focusing on a specific subject matter like science education. Also, they might “create good relationships with (other children), their teachers, and the larger community”. One may also argue that school grounds offer a significant, but untapped, potential to assist scientific teachers in achieving meaningful contextualization of learning due to their closeness and availability of access. Of course, there are a lot of other extremely rich contexts, including museums and field excursions, that can enable engaging real-life/school content grounding. Datt and Chunawala found that student engagement is crucial for any learning, children were interested, involved and enthusiastic during outdoor activities and also children's obvious happiness and enjoyment may be considered indicative of their emotional engagement in the outdoor tasks [17].

The NEP (2020): document of India in its Part 4 section while explaining the methods of teaching, has given importance to activity based outdoor teaching. This approach is essential to develop creativity, exploratory learning, and arousing interest among learners and to achieve all round development of the learner.

OBJECTIVES OF THE STUDY

1. To survey the present teaching method practised in the secondary schools to teach science.
2. To review the research literature related to innovative science teaching method.
3. To review the related literature related to effectiveness of practising outdoor science teaching in teaching learning process.
4. To plan a strategy to teach science beyond the classroom situation.

STRATEGY FOR TEACHING SCIENCE BEYOND CLASSROOM

Hence with all these theory and review of literature background, the researcher strongly urges to introduce a strategy of teaching, outdoor science teaching to conduct an experimental study. And these are some of the activities which the researcher carried out during the execution of strategy:

1. Nature walk, to understand the components of the ecosystem and its interrelationship.
2. Visit to park and pond, component and factors of artificial and natural ecosystem. Aquatic ecosystem and adaptation in aquatic plant.
3. Visit to science museum.
4. Visit to science centre: physics, chemistry and biology concepts and also to have practical hands on experience to understand the law.
5. Visit to zoo: biodiversity, life style and food habit of wild animals.
6. Visit to planetarium: space, planets etc.
7. Visit to farm and farm house: agriculture, farming, soil, maintenance of soil, organic and chemical fertilizer.
8. Visit to factory (tiles, paper, glass, plastic, soap etc.): raw materials used and process of manufacturing.
9. Visit to milk dairy: processing of milk, pasteurization and different dairy product.
10. Visit to fire service station: fire and safety management demonstration.
11. Visit to compost manufacturing unit: from wet waste, from biodegradable waste.
12. Visit to cloth manufacturing unit: different types of synthetic and natural fibre.
13. Visit to food processing unit: to know difference between natural and synthetic food.
14. Gardening in school.
15. Visit to workshop in ITI college (department of electricity and automobile): practical experience of working of machine etc.

These outdoor activities help in attaining objectives of teaching science.

OUTCOME OF THE STUDY

1. Using only traditional method like chalk and talk method, lecture method will not be effective in teaching science.
2. Teaching science beyond the classroom is effective method of teaching to attain the objectives of teaching science.
3. Teaching science beyond the classroom will develop interest in teaching learning process.

CONCLUSION

The present study is a descriptive type study and here researcher surveyed present method of teaching practiced in secondary schools to teach science in neighbourhood schools and reviewed research literature on innovative methods of science teaching; and the researcher found that teaching science beyond the classroom following the strategy planned by the researcher is one of the effective methods.

REFERENCES

1. Sozbilir M. Turkish chemistry undergraduate students' misunderstandings of Gibbs free energy. *Univ Chem Educ.* 2002 Jan; 6(2): 73–83.
2. da Silva Campos CV, da Silva Farias R, da Silva SM, Severi W, Brito LO, Gálvez AO. Production of *Daphnia similis* Claus, 1876 using wastewater from tilapia cultivation in a biofloc system. *Aquac Int.* 2020 Feb; 28(4): 403–19.
3. Ayotte-Beaudet JP, Potvin P, Lapierre HG, Glackin M. Teaching and learning science outdoors in schools' immediate surroundings at K-12 levels: A meta-synthesis. *EURASIA J Math Sci Technol Educ.* 2017 Jun 15; 13(8): 5343–63.

4. Dettweiler U, Ünlü A, Lauterbach G, Becker C, Gschrey B. Investigating the motivational behavior of pupils during outdoor science teaching within self-determination theory. *Front Psychol.* 2015 Feb 18; 6: 125.
5. Festeu D, Humberstone B, Baasch S. Non-formal education through outdoor activities guide. High Wycombe, UK: European Institute for Outdoor Adventure Education and Experiential Learning. England: High Wycombe; 2006.
6. Francis TB, Abbott KC, Cuddington K, Gellner G, Hastings A, Lai YC, Morozov A, Petrovskii S, Zeeman ML. Management implications of long transients in ecological systems. *Nat Ecol Evol.* 2021 Mar; 5(3): 285–94.
7. Rios JM, Brewer J. Outdoor education and science achievement. *Appl Environ Educ Commun.* 2014 Oct 2; 13(4): 234–40.
8. Maulina D. Bio-literacy perspective: A Study of implementation of outdoor learning-based science process skills in plant introduction. *J Bioedukatika.* 2020; 8(1): 31–7.
9. Mapotse TA, Mashiloane TK. Nurturing learners' awareness of littering through environmental campaigns: An action research approach. *Eurasia J Math Sci Technol Educ.* 2017 Nov 10; 13(10): 6909–21.
10. Eckhaus E, Klein G, Kantor J. Experiential learning in management education. *Business, Management and Economics Engineering (BMEE).* 2017 Jun 29; 15(1): 42–56.
11. DeZure D, Van Note Chism N, Deane Sorcinelli M, Cheong G, Ellozy AR, Holley M, Kazem B, Atrushi D. Building international faculty-development collaborations: The evolving role of American teaching centers. *Change: The Magazine of Higher Learning.* 2012 May 15; 44(3): 24–33.
12. Guerrero GR, Reiss MJ. Science outside the classroom: exploring opportunities from interdisciplinarity and research–practice partnerships. *Int J Sci Educ.* 2020 Jun 12; 42(9): 1522–43.
13. de Escha CE, Zeidler S, van den Berg WE, Buijsena RA, Jaafara IA, Severijne E, Kushner SA, Willemsena R. Altered social interaction after region or cell-Type specific deletion of Fmr1 expression in mice. *Therapeutic Targets and Translational Endpoints in Fragile X Syndrome.* 2014; 101.
14. Guerrero GR, Reiss MJ. Science outside the classroom: exploring opportunities from interdisciplinarity and research–practice partnerships. *Int J Sci Educ.* 2020 Jun 12; 42(9): 1522–43.
15. Thalib SB, Ahmad MA. The Outdoor Learning Modules Based on Traditional Games in Improving Prosocial Behaviour of Early Childhood. *Int Educ Stud.* 2020; 13(10): 88–104.
16. Rickinson M, Dillon J, Teamey K, Morris M, Choi MY, Sanders D, Benefield P. A review of research on outdoor learning. National Foundation for Educational Research and King's College London; 2004 Mar.
17. Datt S, Chunawala S. A Comparison of Problems at the Grassroots Level in India Identified by Adults and Children: Implications for Design and Technology Education. *Design and Technology Education.* 2018; 23(1): n1.