FOSTERING SCIENTIFIC TEMPERAMENT AMONG STANDARD EIGHT STUDENTS THROUGH SCIENCE SUBJECT USING PARTICIPATORY APPROACH.

ACTION RESEARCH REPORT 2023 - 2024

SUBMITTED BY

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SUBMITTED TO

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DECLARATION

Here by I declare that this action research report entitled as "Fostering Scientific Temperament among Standard Eight Students through Science Subject using Participatory Approach" is a work originally carried out by me and no part of this work is a reproduction from any other sources. I also declare that this work has not been submitted earlier.

Station: Palayampatti.

Date: Signature of the Investigator

[T. ELANGO]

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CERTIFICATE

This is to certify that the Action Research entitled," Fostering Scientific Temperament among Standard Eight Students through Science Subject using Participatory Approach" submitted by T.Elango, senior lecturer, DIET, Manjur is a record of bonafide Action Research work done by him and it has not been submitted for the award of any degree, diploma, associateship, fellowship of any Univercity/Institution.

Place; Palayampatti

Date;

Signature of the Principal,

DIET, Palayampatti

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2. INTRODUCTION

"The scientific temper points out the way along which man should travel. It is the temper of a free man."

– **Jawaharlal Nehru**

Currently, in many countries, the promotion of a favorable science-related temperament is considered to be one of the most important aims of science education programs. The development of any country is based on scientific knowledge as well as a favorable attitude towards science among its people. The aim of the present study is to check felt problems in studying science and attitudes towards science among adolescent students of the 8th grade.

Only when the younger generation has a scientific temper and a rational approach towards making life choices the country can achieve rapid development. Every child has an innate curiosity to explore, investigate, ask questions, and seek answers. A child's scientific temperament is influenced by the environment. For fostering a culture of inquiry, critical thinking, and a deeper understanding of the world around them, scientific temperament is essential. In standard eight, students begin to grasp more complex scientific concepts, and this stage offers an opportunity to shape their approach to problem-solving. Employing a participatory approach in teaching science at this level can contribute to nurturing their scientific mindset.

Science is a systematic study and investigation of nature through observation, experimentation, and theorizing in order to arrive at an understanding of natural phenomena. A participatory approach in teaching involves engaging

students actively in the learning process through inquiry-based learning, hands-on experiments, and collaborative activities. By encouraging students to explore, question, and experiment, they not only gain a stronger grasp of scientific principles but also develop essential skills such as teamwork, communication, and analytical thinking.

Integrating real-world applications and the use of technology further enhances the learning experience and makes science more relevant and exciting for students. Additionally, providing opportunities for reflection, discussion, and project-based assessments allows students to apply their knowledge in meaningful ways and reinforces their learning.

Ultimately, fostering a scientific temperament among standard eight students through participatory teaching methods in science can empower them to become curious, informed, and thoughtful individuals who are better equipped to navigate the complexities of the modern world.

The concept of scientific temper was discovered by Pt. Jawaharlal Nehru. Scientific temper is an attitude, a way of living, which should be applicable to all aspects of our life (Dhar, 2009). The scientific temperament is a certain mental attitude that supports clear-headed reasoning. It is the need of the time for all citizens to develop rational and logical thinking through scientific temper.

This term '*scientific temper*' was first introduced by *Pt. Jawaharlal Nehru* in his book '**The Discovery of India**' in 1946;

In this book, other than the nation's historical, cultural, and philosophical perspective, the term scientific temper gets the most attention. Scientific temper is defined as "the scientific approach and temper are a way of life, a process of thinking, a method of acting and associating with our fellowmen" (Nehru, 1946).

He also referred to it as “the temper of a free man.” Though the term scientific temper was used for the first time in Indian literature in 1946, a similar phenomenon was already found in ancient Indian culture and tradition.

This is not new for ancient Indians, but they had shown and expressed the scientific temperament in their views, beliefs, and actions. *Jain, Sankhya, Vaisheshika, Nay, and Buddhist philosophies* repeatedly emphasize the importance of logic and the spirit of inquiry. In the Vedic era, questioning and logical thinking of mind were always given due credit to be developed through education.

Even in Buddha’s **Kalama Sutra**, importance was given to the encouragement of a rational attitude, stating that “Believe nothing merely because you have been told it or because you yourself imagined it; do not believe what your teacher tells you for the sake of respect for the teacher.”

"**Argumentative Indian**", written by Nobel Laureate *Prof. Amartya Sen*, describes the scientific temperament as a distinguishing feature of Indian intellect.

In 1976, it was added as a fundamental duty (Part IV-A) in the 42nd Amendment to the Constitution, Article 51A(h) of the **Constitution of India, 1950**, which declares that “It shall be the duty of every citizen of India to develop the scientific temper, humanism, and the spirit of inquiry and reform.” Scientific temperament may be considered a part and parcel of the educational system. It was felt to be imbibed among the youth starting from the initial classes through curriculum transactions, and it should be an important component of the curriculum at all stages. The nation's vision, foresight, and aspirations are primarily expressed in educational policies to guide the construction of the curriculum for various educational levels. Therefore, it needs to have a place in educational documents as

the vision. An attempt is also made to inculcate scientific temper among school students.

Scientific temper is a way of life that involves individuals using scientific methods such as questioning, observation, testing, hypothesizing, analyzing, or communicating on a regular basis. Considering the importance of scientific temper in the Indian education scenario, an attempt is made in the present study to inculcate scientific temper among school students.

Terms like scientific temper, scientific attitude, scientific thinking, scientific outlook, science education, logical thinking, rational thinking, and the spirit of inquiry are found in the following documents: three Education Commission reports, four National Policies on Education, four National Curriculum Frameworks for school education, one National Curriculum Framework for teacher education, five Policies on Science and Technology, and two reports of the Committees especially formed for scientific temper.

Keywords:

Scientific Webster's new twentieth century dictionary second Edition defined 'Scientific' as;

1. Pertaining to or used in natural science.

2. Evincing or endowed with knowledge of science.

3. According to, based on, or using the rules of principles of science; systematic or exact.

4. Trained in the following or observing the principles or methods of science.

“Temper” as per Webster’s New Twentieth century Dictionary, 'Temper' is frame of mind; disposition; mood; habitual frame of mind.

Therefore, Scientific Temper is a frame of mind endowed with knowledge of science trained in observing principles and scientific process.

“*Participatory approach*” as

Participatory approach or interactive teaching method or learner centered teaching method stresses the subjectivity of learners and the self-construction of knowledge.

Challenges faced by science teachers: attracting students’ interest by emphasizing the relevance of science in their own lives. In certain schools, initiatives such as science labs for school students have been initiated to counteract dropouts in school subjects such as chemistry and there is shortage of skilled professionals in science. Hence the combination of the above mentioned measures seems to be a promising approach to arouse students’ interest in scientific concepts.

Chemistry-based Information in Social Media in Light of Scientific Media Literacy—Teachers’ Views and Classroom Implementation in Secondary Education with an emphasis on the critical reflection of social media in the science class room. In this context, we present the results of an exploratory interview study with teachers ($N = 8$), which showed a rather skeptical attitude towards the use of social media in science classrooms. Major points of concern included a lack of experience with social media and a lack of suitable teaching materials.

"Science is systematic study and investigation of Nature through observation, experimentation and theorizing in order to arrive at an understanding of natural phenomena".

Teachers should also create an active learning environment to enhance students' perceived autonomy and competence, with choices and opportunities for self-directed learning and activities that might increase their professional and personal feeling of mastery.

The teacher can develop teaching materials for lower secondary school students, raising their awareness of the usefulness and value of learning science, enhancing their interest and promoting the advancement of science. The results indicate that in this class model teachers can connect regional companies and science lessons, transforming students' attitudes to science learning.

Context-based learning approaches have been introduced in several countries all over the world to make relevancy and interest to enhance students' learning outcomes. This unconventional approach emphasizes meaningful learning through higher-order thinking. And there was educational challenge to develop suitable tasks adapted to both affective and cognitive aspects of learning.

Importance of developing a scientific temperament in students:

1. To make relevancy in the industry, a logical approach is important to compete in a highly competitive job market.
2. It boost up the student's understanding level.
3. It motivates the students to use logical application of concepts in the real world.

A few dimensions of scientific temperament:

1. Curiosity:

Curiosity is the mother of all inventions and being the driving force behind some of the greatest inventions and discoveries. For example curiosity to find out the reason behind the falling of an apple was the reason why Sir Isaac Newton invented the Laws of Motion. The first and foremost step towards building a student's scientific temperament is to encourage them to ask more questions and appreciating them for their creations.

2. Critical thinking:

Motivating students to read extra in order to improve their information analysis will develop scientific temper. Making learning application based and explaining the concept with the help of real-life examples will improve the critical thinking. For example, discoloration of leaves because of reduced chlorophyll.

3. Skepticism:

By employing games such as chess and Sudoku that improves logical and strategic skills. By using multimedia (via podcasts, videos), a teacher can help develop multiple sensory learning capabilities in a child.

4. Open-mindedness is not something that comes naturally to everyone. Open-mindedness is the ability or willing to listen to and consider other people's ideas and suggestions with evidence based.

5. Persistence is the effort required to do something and keep doing it till the end, even if it's hard and hard work without stopping till the end.

6. Ethical Responsibility in simple terms means knowing the difference between right and wrong and continuing to do the right thing.

7. Collaboration is to work jointly, cooperatively, willingly with others or together especially in an intellectual endeavor. Collaboration is to commit to the possibility of producing an outcome greater than one to be developed in a silo.

Government schemes for promoting scientific temperament among youths are:

i. Knowledge and Awareness Mapping Platform (KAMP)
ii. Rashtriya Avishkar Abhiyan (RAA)
iii. Scheme for Young Scientists and Technologists (SYST)

Scientific Thinking. - Different from the learning of scientific facts in such a way instead of learning what other people have discovered. Scientific thinking leads children to make their own discoveries.

Scientific Method - An organized plan used for gathering, organizing and communicating information and it involves following six steps;

i. State the problem.

ii. Gather information.

iii. Form a hypothesis.

iv. Test the hypothesis.

v. Analyze data.

vi. Draw conclusions.

Scientific temper is a way of life that involves individual using scientific methods such as questioning, observation, testing, hypothesizing, analyzing or communicating on a regular basis.

3. BACKGROUND OF THE STUDY

In the modern world, scientific literacy, scientific thinking, and scientific temperament are essential skills for students. Scientific temperament consists of curiosity, critical thinking, logical reasoning, problem-solving, a willingness to question and investigate, and an understanding of the scientific method. It is an essential quality that allows for a methodical approach to various situations. For standard eight students, scientific temperament is particularly important because they are on the cusp of adolescence and beginning to form their views about the world.

Traditional teaching methods, such as rote memorization and passive learning, may not adequately cultivate a scientific mindset. These approaches often focus on the transmission of information and do not encourage students to engage with the material critically or apply it to real-world situations. Due to these reasons, students may struggle to see the relevance of scientific concepts and lose interest in the subject.

A participatory approach to teaching science is a method that can address these issues. By making students active in their learning through inquiry-based activities, hands-on experiments, and collaborative projects, educators can create an engaging and interactive learning environment. This approach encourages students to ask questions, investigate concepts, and apply their knowledge practically. It also promotes a sense of ownership and responsibility for their learning, motivating them to explore and understand scientific ideas more deeply.

Although the importance of scientific temper is universally acknowledged, efforts to foster the same are almost non-existent in the present education system. The current education system, loaded with rhetorical teaching lessons,

unchallenging assignments, and exam-oriented values, gives teachers no scope for fostering scientific temper. Most of the time, teachers themselves are confused about how to inculcate scientific temper in children even if they want to. Teachers themselves are also products of a rigid, uncreative, and inflexible system. In schools, teachers lack the know-how to inculcate it among the students.

There is also a growing belief that the systematic, analytical, rational, and objective approach to problems, which are the hallmarks of the scientific method, may be of primary help in solving the sundry problems of life, vocation, and society at large.

Furthermore, as students are exposed to real-world applications of scientific principles and modern technologies, they can appreciate the impact of science on their lives and the broader world. By fostering a scientific temperament through a participatory approach, educators can help standard eight students develop essential skills that will benefit them academically and personally, laying the foundation for future success in a world increasingly shaped by science and technology.

4. NEED AND SIGNIFICANCE OF THE STUDY

The meaning of education is to change children's behavior and hence it conforms to societal demands and expectations. Objective of learning science is to get scientific mindset which is significant throughout the world. Values, attitudes, aptitudes, and appreciation are to be developed and always a part of science education.

Need:

Development of Critical Thinking: Fostering scientific temperament encourages students to think critically, evaluate information objectively, and question assumptions, which are essential skills in an age of information overload and misinformation.

Preparation for Future Challenges: As students' progress through their academic and professional lives, they will encounter complex challenges that require scientific knowledge and methods. Developing a scientific temperament equips them with the tools they need to tackle these challenges.

Promoting Curiosity and Inquiry: Encouraging students to ask questions and explore topics in depth promotes a lifelong love of learning and a natural curiosity about the world.

Understanding the World- Science provides a framework for understanding the natural world and how it works. By fostering a scientific temperament, students can better understand, appreciate and engage with their surroundings.

Improving Problem-Solving Skills: Through participatory learning, students gain experience in solving problems systematically and creatively.

Encouraging Responsible Citizenship: A scientific mindset helps students in issues such as health, the environment, and technology. It is crucial for responsible citizenship in today's society.

Significance:

Participatory learning methods lead to better comprehension and retention of scientific concepts, resulting in improved academic performance. When students actively engage with their learning, they are more likely to be motivated and invested in the subject matter. This increased engagement helps maintain their interest in science and encourages a deeper understanding of the material.

Group projects and discussions foster collaboration, communication, and teamwork among students—skills that are highly valued in the workforce. By working together, students learn to appreciate diverse perspectives and develop essential interpersonal skills. This collaborative approach also connects theoretical knowledge to practical applications, helping students see the relevance of science in their everyday lives.

Encouraging exploration and experimentation through a participatory approach can inspire students to pursue careers in science and technology, becoming the innovators of tomorrow. By fostering an environment that values inquiry and creativity, educators can nurture the next generation of scientists and technologists.

Moreover, participatory approaches can be tailored to different learning styles and backgrounds, making science education more accessible and inclusive.

This ensures that all students, regardless of their starting point, can benefit from a science education that meets their needs.

5. OBJECTIVES OF THE STUDY

1. The major objective is to foster the scientific temperament among standard eight students through science subject using participatory approach,
2. To see the effect of Participatory Approach on Fostering the Scientific Temperament among Standard Eighth Students through Science Subject,
3. To identify and promote scientific temper among students,
4. Bringing scientific awareness among students,
5. To Promote and help students learn science differently,
6. Disseminating information of Action research to teachers through dissemination workshop,
7. To reach out fellow students especially in remote areas to popularize science,
8. To stimulate spirit of curiosity, inquiry, innovation, and creativity to supplement conventional education and foster scientific temper,
9. To create awareness on low cost and waste material available in school environment in organizing field trip,
10. To develop experimental bent in conducting individual and group Projects,
11. To analyze and giving reasons for changes in air pressure,
12. To develop patience in observing the experimental results,
13. To develop cautiousness in handling the equipment during experiment,
14. To develop habit of accuracy in measuring and weighing objects,

15. To develop honesty in reporting experimental results,
16. To report experimental results consistently,
17. To establish cause and effect relationship among science concepts.
18. To avoid superstitious belief for the science concept,
19. To share the experiences freely in group discussions,
20. To judge the facts based on experimental evidence,
21. To test and verify the factors essential for afforestation,
22. To develop questioning mind by organizing quiz program,
23. To develop tolerance commitment by organizing exhibition,
24. To appreciate the utility of air in daily life activities,
25. To apply scientific principles to solve problem in day to day life,
26. To respect others' suggestions in organizing club activities,
27. To promote rational thinking through individual and group practical,
28. To promote critical thinking by analyzing causes of pollutions,
29. Enabling students and parents to understand their inherent potential for different career choices through mapping and helping them to identify scientific attitude,
30. To make awareness among students on the latest developments in emerging science and technologies,
31. Inculcating specific attributes essential to become a successful scientist or technologist,

32. To create a healthy competitive spirit among students based on performance levels.

6. IDENTIFICATION OF THE PROBLEM

On a school visit, while observing the science class, the teacher followed rote learning and memorization with passive learning of children. In science teaching, specifically for upper primary students, process-based learning is essential.

For upper primary students, there is a lack of opportunities for fostering a culture of inquiry, critical thinking, and a deeper understanding of the world around them. Science is the investigation of nature through observation, experimentation, and theorizing to arrive at an understanding of natural phenomena. Students didn’t gain first-hand learning experience by watching and involving themselves in lab activities.

There was no use of riddles and brain teasers available on smartphones to encourage their scientific exploration. NGO organizations like ACER and NAS reports reveal the minimum level of scientific temperament among standard 8 students and the prevalence of rote memorization and a marks-scoring mindset among students and parents.

Educational data also reveal that very few students undergo research studies. Therefore, from the school level, it is essential to motivate children’s scientific temperament.

Identifying the problem within the context of fostering scientific temperament among standard eight students through science subjects using a participatory approach involves recognizing specific challenges that may hinder students' engagement with and understanding of scientific concepts. Here are some key problems to consider:

1. Traditional teaching methods often focus on rote memorization rather than encouraging critical thinking, creativity, problem-solving, decision-making, or inquiry-based learning, which may cause disengagement and a lack of interest in science.

2. Lack of practical application does not connect theoretical concepts to real-world applications in science education, and hence students may struggle to see the relevance of science in their lives and future careers.

3. Limited resources in some educational settings may cause limited access to laboratory facilities, technology, and materials for hands-on experiments and participatory learning approaches.

4. Teacher preparedness may need to be equipped with the skills or training necessary to implement a participatory approach effectively, which includes facilitating group work, guiding inquiry, and supporting student-led learning.

5. Cultural and socioeconomic barriers: Student’s backgrounds can influence their attitudes toward science and their ability to engage in participatory learning. Cultural norms, language barriers, and socioeconomic challenges can impact students' learning experiences.

6. Traditional assessment methods may not accurately measure students' understanding of scientific concepts and their ability to apply them in practical scenarios. They do not encourage the development of a scientific temperament.

7. Limited exposure to scientific careers and related fields may prevent students from appreciating the potential opportunities available to them and the importance of scientific thinking.

By identifying these problems, educators can address the barriers to fostering scientific temperament among standard eight students through science education. Solutions may include updating teaching methods, providing resources for participatory learning, offering teacher training, and integrating real-world applications into the curriculum. Addressing these challenges can lead to more engaging and meaningful science education experiences for students.

From the above classroom observations and data from various media, the investigator feels the essential need to improve the scientific temperament of middle school students for the development of 21st-century skills.

7. PROBABLE CAUSES FOR THE PROBLEM

i. Lack of following Enhanced Learning Outcomes,
ii. Lack of developing and encouraging curiosity among students in the class room. Curiosity is the mother of all inventions.
iii. Lack of Participatory learning methods may not lead to better comprehension and attitudes,
iv. Lack of literate parents to guide their kids in learning science concepts,
v. Lack of learning resources to make curiosity,
vi. Lack of making students to ask questions
vii. Lack of opportunities for getting critical thinking and problem solving skill
viii. Lack of equipped lab facilities for individual activities
ix. Lack of Engagement for students likely to be motivated and invested in the subject matter
x. Lack of using multimedia to help them understand new concepts or ideas, a teacher can help develop multiple sensory learning capabilities in a child.
xi. Traditional teaching methods, such as rote memorization and passive learning, may not adequately cultivate a scientific mindset.
xii. Lack of using podcasts, videos, and other mediums to help child get closer to their line of thinking and smartness.
xiii. Lack of making concepts fun to learn
xiv. Lack of interest in science subject
xv. Lack of motivation to read extra books in order to improve their information analysis.
xvi. Lack of making learning application based and explaining the concept with the help of real-life examples .

Probable causes for the problems associated with fostering scientific temperament among standard eight students through science subjects using a participatory approach include:

1. Inadequate Teacher Training in participatory teaching methods and inquiry-based learning may lead to a lack of confidence or skill in implementing these approaches effectively.

2. Resource limitations such as laboratory equipment, technology, learning materials and class rooms can hinder the ability of teachers to conduct hands-on experiments and participatory activities in the classroom.

3. Traditional Pedagogical Approaches: Persistent reliance on traditional teaching methods such as lecture-based instruction and rote memorization can limit students' opportunities to engage in active, inquiry-based learning.

4. Traditional Assessment Practices such as multiple-choice tests and rote recall, may not use in fostering scientific temperament. Here prioritization is only for memorization and not for critical thinking and application.

5. Curriculum Constraints: Inflexible or overly prescribed curricula may restrict teachers' ability to incorporate participatory learning methods and real-world applications into their science instruction.

6. Lack of Exposure to Science-Related Careers may affect the students' interest and understanding in science.

7. Cultural and Socioeconomic Barriers: Students from different cultural backgrounds or those facing socioeconomic challenges may encounter difficulties engaging with science education. For example, language barriers and lack of access to additional support may hinder participation.

8. Limited Encouragement of Inquiry: Scientific mindset may be stunted if students are not encouraged to ask questions, explore, and experiment. And their interest in science may get diminished.

9. Lack of Administrative Support: School administrators may not prioritize or support the shift toward participatory learning methods in science education, leading to a lack of resources and training for teachers.

10. Resistance to Change: Both teachers and students may resist to come to follow modern trends or methods due to comfort with familiar approaches, fear of the unknown, or perceived challenges in transitioning to new teaching methods.

Addressing these probable causes requires a multifaceted approach, including teacher professional development, curriculum adjustments, investment in resources, and support from school administration. By tackling these issues, educators can create an environment conducive through participatory approach to fostering scientific temperament among standard eight students.

8. PROBABLE SOLUTIONS FOR THE PROBLEM

Following enhanced learning outcomes in the classroom;

1. Developing and encouraging curiosity among students in the class room. Curiosity is the mother of all inventions,
2. Usage of Participatory learning methods may lead to better comprehension and attitudes,
3. Giving awareness to parents to guide their kids in learning science concepts,
4. Getting adequate learning resources to make curiosity,
5. Teachers may try to make students to ask questions,
6. Creating opportunities to inculcate critical thinking and problem solving skill,
7. Creating equipped lab facilities for individual activities,
8. Engagement to be followed for motivating the students and invested in the subject matter,
9. Using multimedia to help them understand new concepts or ideas, a teacher can help develop multiple sensory learning capabilities in a child,
10. Avoiding rote memorization and passive learning, may adequately cultivate a scientific mindset,
11. Using podcasts, videos, and other mediums to help child get closer to their line of thinking and smartness,
12. Making concepts fun to learn,

13. Motivating children to read supplementary and extra book in order to improve their information analysis,
14. Making learning application based and explaining the concept with the help of real-life examples.

To address the problems associated with fostering scientific temperament among standard eight students through science subjects using a participatory approach, several solutions can be implemented. Firstly, providing ongoing training for teachers in participatory teaching methods, inquiry-based learning, and student-centered approaches is essential. Workshops and resources can help teachers develop skills in facilitating group work, guiding student inquiry, and supporting project-based learning.

Investing in laboratory equipment, technology, and other materials necessary for hands-on experiments and participatory activities are crucial. Funding and support from local organizations or government grants can enhance science facilities and resources. Additionally, advocating for curricula that allow flexibility for teachers to incorporate participatory learning and real-world applications is important. Integrating project-based learning, real-world problem-solving, and interdisciplinary connections into the curriculum can also make a significant difference.

Introducing alternative assessment methods such as portfolios, presentations, and project assessments can better evaluate students' understanding and application of scientific concepts. Using formative assessments to provide feedback and guide student learning throughout the instructional process can further support this.

Utilizing technology such as virtual labs, simulations, and educational apps can enhance learning experiences and make science more accessible and engaging. Providing training for teachers on effectively integrating technology into their lessons is also beneficial.

Creating opportunities for students to connect scientific concepts to real-world situations through field trips, guest speakers, and industry partnerships can help them see the relevance of science. Encouraging students to explore local environmental or community issues using scientific methods can further reinforce this connection. Providing additional support for students who face cultural or socioeconomic barriers, such as language support, mentoring, and resources for outside-of-school learning, is essential. Offering differentiated instruction and assessment to accommodate diverse learning styles and abilities can also support diverse learners.

Encouraging students to ask questions, experiment, and engage in scientific investigations can promote a culture of inquiry. Creating a classroom environment that supports risk-taking and celebrates curiosity is key. Gaining support from school administrators to prioritize and invest in participatory learning approaches in science education can also make a significant impact. Advocating for policies and resources that promote innovative teaching and learning in science is crucial.

Involving parents, guardians, and the community in science education can reinforce the importance of scientific literacy and inquiry. Hosting science fairs, open houses, and other events to showcase students' work and achievements can further engage the community. By implementing these participatory approach solutions, educators can create a more engaging, inclusive, and effective science

education environment that fosters scientific temperament among standard eight students.

9. HYPOTHESIS

There will be significant improvement on Fostering Scientific Temperament among Standard Eight Students through Science Subject using Participatory Approach.

There will be significant difference in mean scores of pre and post test scores of Students studying in standard eight of 8^{th} ward Municipal middle school, Rajapalayam, on Scientific Temper while using participatory approach.

10. RESEARCH DESIGN

TARGET GROUP:

Students studying in standard eight at 8th ward Municipal middle school, Rajapalayam, were all selected and treated as a target group for the study.

TOOL:

In the present study, tool was developed by the investigator to measure the scientific temper of students. For collecting desired data for the present study, a questionnaire prepared by the researcher was used. Five point Likert Rating Scale was constructed by the researcher to measure scientific temperament of the target group. The tool was the scientific temper scale developed by the investigator.

The tool was created to test the hypothesis, to learn more about scientific temperament of school students and to develop positive attitudes about science. The five-point scale with levels of—Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree—make up the statement of the questionnaire. A request was made on the first page of the questionnaire for open and honest responses from the students.

Scientific Temper scale; By reviewing pre-existing scales related to science education and with the help of existing literature and on consultation with the guide and other experts in the field of education, the following dimensions of scientific temper was identified to construct scientific temper scale.

Scientific Temper Dimensions; 1. Questioning, 2. Curiosity, 3. Observation, 4. Analysis, 5. Rationality, 6.Reasoning, 7. Creative thinking, 8. Scientific approach, 9. Intellectual Honesty, 10. Skepticism, 11. Experimental Bent, 12. Suspended judgment, 13.Open mindedness, 14. Objectivity, 15. Cause and effect

relationship, 16.Cautiousness, 17. Aversion to superstition, 18. Self –confidence, 19.Appreciation of utility of science in daily life activities, 20. Respect for other's view, 21. Innovation, 22. Honest reporting, 23. Problem solving.

But in this study, Scientific Temper dimensions such as 1.Curiosity, 2.Open mindedness 3.Scepticism, 4.Critical thinking, 5.Persistance, 6.Ethical responsibility, 7.Collaboration, were used to construct the tool.

As with any scale, it would require validation and refinement to ensure its reliability and validity across different populations and contexts.

Consulting the experts (as it is action research); after framing the questionnaire, the investigator made consultation with experts on each and every item of the questionnaire. They suggested few modifications in order to have a relevant item in the questionnaire. Finally the investigator arranged all the items with 20 statements and distributed the marks.

Students would rate each item of a questionnaire (e.g., strongly disagree, disagree, neutral, agree, strongly agree) to assess their level of agreement or frequency of behaviours which is related to scientific temper in the context of conservation of plants and animals. This scale was administered before and after the class room interventions to measure changes in students' scientific temper over time.

METHOD:

Pre-test – Intervention -- Post-test (Experimental method)

Experimental method:

The Investigator adopted experimental method. Experimentation is the classic method of science laboratory. But it has been applied in laboratory settings, such as the classroom where significant factors or variables can be controlled to some degree. The immediate purpose of experimentation is to predict events in the experimental settings. The ultimate purpose is to generalise the variable relationship, so that they may be applied outside the laboratory to a wider population of interest. There are different patterns of experimental research based on the groups used as individual or single group, parallel or equated groups, rotational groups.

In this study, the investigator adopted single group design, which is pretest - posttest design.

One group Pretest - Post test design, while using this design the investigator measures dependent variable, before the independent variable 'X' is applied and then takes its measurement again. Afterwards the difference in the measurement of dependent, if any is computed and is taken as the amount of change as result of independent variable.

Table – 1: *Design of the Study*

Pretest	Independent variable	Post test
Mean of the pretest	Training Implementation (Interventions)	Mean of the post test

STATISTICAL TECHNIQUE:

The statistical measures such as Mean, and Average were applied to analyze the obtained raw scores for testing the hypothesis and drawing the inferences. Mean value found is used to compare the test scores

INTERVENSIONS:

Pre-test to assess the present level of scientific temper before initiating the interventions was conducted.

Image 1: *Conducting Pre-test for the targeted students.*

Principally, there are four components of scientific temperament – curiosity, open-mindedness, analytical or critical mindset and modesty or humility. But in this study, for the sake of upper primary student's level, Scientific Temper Dimensions such as 1.Curiosity, 2.Open mindedness, 3, Skepticism, 4.Critical thinking,

5.Persistance, 6.Ethical Responsibility, 7. Collaboration, were used to foster scientific temperament among the students through the lesson conservation of plants and animals. Conservation of plants and animals is very important for enriched biodiversity that helps in balancing the ecosystem. Plants and animals are the backbone of life on Earth and both depend upon each other in the environment in many ways. Hence the activities coming under the participatory approach have given weightage more to process than knowledge.

5Es instructional model was followed for class room instructions because for learning science it is very useful to construct knowledge (constructivism). It was first proposed by **Dr. Rodger Bybee** as a way to structure science lessons and enhances students' understanding of scientific concepts. Although the 5E instructional model was initially developed for science education, it has become a popular instructional model across all subjects due to its effectiveness. In addition, the 5E learning cycle boosts student engagement and motivation through a constructivist approach. Students construct their own understanding of concepts and ideas through active learning, exploration, critical thinking, and inquiry-based learning. Scientific temper essentially means the cultivation of these principles/ values as a temperament and way of life. Throughout the process, students work collaboratively to observe, investigate, analyze, and draw conclusions.

Participatory approach is a form of a reflective teaching approach which is sometimes termed as interactive teaching method or learner centered teaching method. This method stresses the subjectivity of learners and the self-construction of knowledge. It is a shift from a belief that learners are empty plate who are supposed to be imparted with knowledge (teach concept) to a belief that learners can construct knowledge and learn on their own if properly guided (learn concept) (Kafyulilo). Participatory methods expect a high degree of activity and personal

involvement of participants in the learning process. . However, it is certainly possible to inculcate scientific temper such as Curiosity, Open mindedness, Skepticism, Critical thinking, Persistence, Ethical Responsibility, and Collaboration using Participatory approach.

1. Engagement phase;

The first phase of a 5E instructional model is the Engagement phase. This phase arouses student curiosity and helps students make connections with previously learned concepts, which aids in the retention of new knowledge. In this phase, students engaged and prime their thinking by activating prior knowledge through short activities.

The class was started with a warm up QUIZ to find out the previous knowledge of the students: A picture chart /PPT /video of plants and animals was used to observe and list out the animals which students know. For example, investigator introduced challengeable problems by showing and inquiring about a series of images and short video clips.

What are the ways for conservation of plants and animals?

What is the concept and importance of conservation of plants?

What are the threats faced in the way of the conservation of plants and animals?

Why do we need to conserve plants and animals?

Shown Pictures of Green House effect, Global warming, acid rain, cutting trees, Dam construction, hunting wild life animals, forest fire, planting trees, Explore and discuss about habitats of different animals, Observe Green House effect, Global warming, acid rain, cutting trees, Dam construction, hunting wild life animals, forest fire, planting trees and Think critically and logically reason out the logic behind above concepts.

Image 2: *Projecting the video of natural animal habitat.*

To start class discussions among student groups, thought-provoking questions were asked. Picture observation and group discussion were used, encouraging student's critical thinking and logical reasoning in open class discussions. Simple demonstrations and experiments on topics such as soil erosion, global warming, the Red Data Book, and bio-magnification were conducted.

A story was told about **Wangari Maathai**, who founded the *Green Belt Movement in Kenya* in 1977. She was awarded the Nobel Peace Prize in 2004 for her efforts. Additionally, YouTube videos were embedded and interactive questions were included to assess prior knowledge and stimulate curiosity, critical thinking, open-mindedness, skepticism, and collaboration.

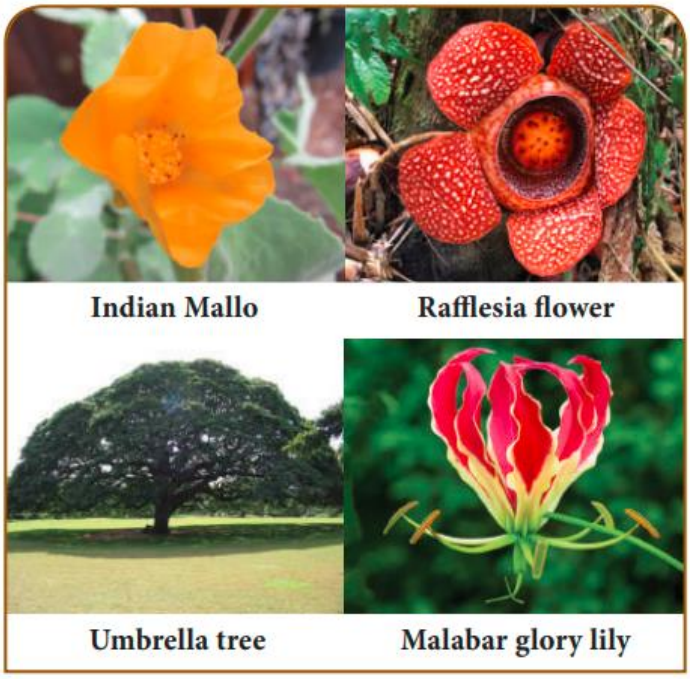
2. Explore phase;

Students learn better when they make meaningful connections between their prior knowledge and new information. Therefore, the Explore phase aimed to connect concepts from the Engage phase to new concepts students will learn in the lesson. To help students make this connection, the investigator used guided inquiry activities that allowed students to share observations, use critical thinking, and collaborate.

In this phase, students came to understand new concepts such as deforestation, afforestation, and reforestation, and were able to connect them with the knowledge gained in the previous phase. Students were able to list endangered species, recognize the importance of wildlife conservation, learn about the Red Data Book, understand the importance of the People's Biodiversity Register, and comprehend the functions of animal welfare organizations.

In a pair-and-share activity, students were asked to form pairs of their own choosing. The pairs were then asked to find the meanings of specific concepts and explain them to the whole class. An expert, a forest guide, was invited to discuss topics such as deforestation, afforestation, reforestation, wildlife conservation, the Red Data Book, the People's Biodiversity Register, and animal welfare organizations with the students.

Image 3&4: *Animals and plants of Endangered species.*



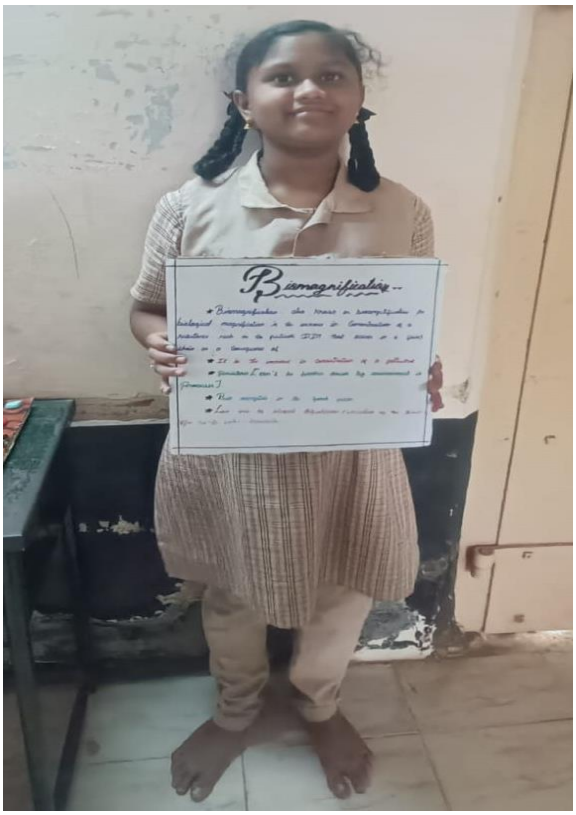
To add a fun element to a child's scientific thinking, games like chess were played, which help in developing logical sequencing and strategic skills. Reading comprehension passages were also used to improve students' knowledge and nurture their scientific temper. Concepts such as the effect of deforestation and the effect of bio-magnification were given to the students for presentation. The students were divided into groups of five, and the group that presented first was announced as the winner. In this activity, everyone was encouraged to participate actively. Virtual meetings with experts were arranged if in-person visits were not possible.

Poster Making:

Encouraged students to express their understanding of conservation through art projects, such as creating posters or illustrations of endangered species. Students

are encouraged to draw posters to sensitize them towards “Nature SAVE NATURE, SAVE ANIMALS” as a title for Poster making.

Image 5: *Student Poster presentation.*



Students were given simple projects on PBR (People’s Biodiversity Record) to collect data about number, habitats, various kinds of animals to get sense of responsibility for protection of animals and their habitats.

1. Students were assigned to write essays, poems, or stories that highlight conservation themes (Red data book, Bio-magnification, Blue cross, Animal welfare organization and CPCSEA) for the sake of critical thinking.

2. Classroom Discussions were facilitated on conservation topics, such as Causes and effects of Deforestation. Students were divided into 6 groups and every group discussed about it.
3. Debates were facilitated on conservation topics, such as Afforestation and Reforestation. And it was instructed that the importance of Afforestation and Reforestation should have more stress.
4. Students were asked to prepare case studies of successful conservation projects to stimulate conversation and critical thinking.
5. Planed field trips to nature reserves, botanical gardens, or wildlife sanctuaries to expose students to diverse ecosystems and conservation efforts. Adopting-a-Species or Habitat Programs: For this students were asked to visit nurseries, gardens and parks;
    i. Students were asked to make Partner with local conservation organizations to "adopt" a species or habitat to learn about and support.
    ii. Students were asked to participate in fundraising or awareness campaigns to support conservation efforts if they get such chances.
    iii. Guided inquiry activities were incorporated into Nearpod in several ways. For instance, Nearpod's virtual reality (VR) feature and 3D Objects immerse students in a new topic, allowing them to explore and make observations.

Students can then discuss and make connections on a Collaborate Board or use a Drag & Drop activity on learned concepts.

3. Explain phase;

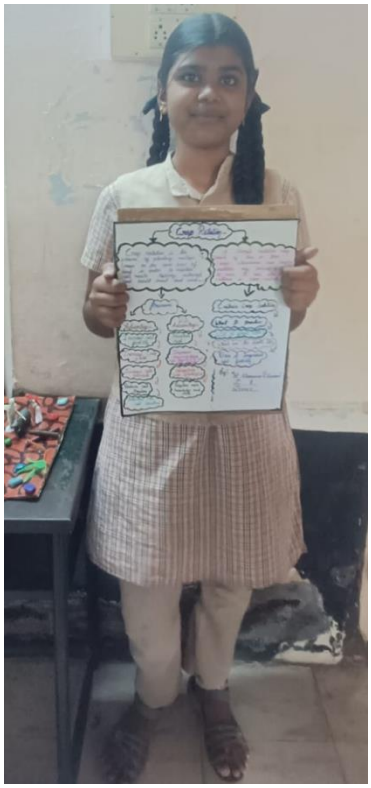
The next phase of the 5E instructional model is the Explain phase. In this phase, students are introduced to new concepts or skills and further connect topics from the Engage and Explore phases. The Explain phase provided students with opportunities to explain and demonstrate their understanding of new concepts they have learned. It also encouraged students to think critically, creatively, and with open-minded enthusiasm.

Field trips and nature walks were arranged to visit parks, forests, and dams, helping students remember concepts such as deforestation, afforestation, the endangerment of species, soil erosion, habitat occupation, hunting, and forest pollution. Visits to local conservation organizations were arranged for students to learn about ongoing projects and initiatives regarding the conservation and preservation of plants and animals. Students visited forest check posts and department offices to inquire about their functions.

Students were engaged in wildlife monitoring projects where they could observe and record data on local animal populations, such as bird counts or insect surveys. Through this activity, students were able to explain and demonstrate the learned concepts with real-world examples. They were taught how to use citizen science apps to report sightings of plants and animals, contributing to larger conservation databases.

1. Students were encouraged to research local endangered species and present their findings in project reports and presentations. Additionally, they were assigned to investigate conservation issues such as habitat loss, global warming, hunting, pollution, or invasive species, and propose solutions.
2. Investigator delivered lectures about key concepts, Afforestation, Reforestation, Endangered Species, Red Data Book, Conservation, Causes for Endangerment that lead to student discussions. Students were allowed to discuss in groups and asked to present to the whole class.
3. Students were asked to incorporate multimedia presentations with a range of visual aids for their individual and group presentations. To help students organize their thoughts, they were asked to work in groups to create concept maps and graphic organizers.

Image 6: *Presenting Concept map..*



4. Students were asked to prepare concept maps and models or hands-on demonstrations to explain specific topics.
5. *Smart board table* instead of Smart board was used by the students for group discussion of concepts.
6. Helped students to add a slideshow, educational videos, audio files, PDFs, 3D Objects, and VR I mages to their presentations using Nearpod app. Also added interaction and feedback activities for students to explain what they have learned, such as Drag and Drops, Collaborate Boards, Draw It's, Quizzes, and Open-Ended Questions. These features provide a fun and interactive learning experience while fully engaging students.

4. Elaborate phase;

The fourth phase of the 5E instructional model is the elaborate phase. This phase invites students to apply what they have learned in more diverse contexts. Teachers can also use this phase to extend students' understanding and further connect the topic to the real world. By transferring knowledge in this way, students gain a deeper understanding of what they have learned. At the same time, students able to think logically and critically with the arousals of curiosity and collaboration.

Project-based activities: *Environmental Stewardship Initiatives*;

- Organized clean-up drives in local parks or waterways to teach students about the impact of pollution on ecosystems.

- Involved students in recycling programs or waste reduction initiatives within the school to promote sustainable practices. These projects were provided to give opportunities to apply their learned science concepts in real life situations.

Adopt a Species or Habitat Program;

- As an extension activity, students took Partnership with local conservation organizations to "adopt" a species or habitat.

'*Integration with Other Subjects*';

- Conservation topics were connected to other subjects, such as language arts, social studies, and art, to provide a holistic approach to conservation education and was followed as an extension activity.

- Students were encouraged in extension activities to know about how conservation issues intersect with our ethics of culture, history, and economics.

Image 7: *Student involved in the computer based learning.*

- Nearpod facilitated the elaborate phase using the activities like Collaborate Boards and Open-Ended questions to encourage debates and discussions. Students used Nearpod, to Draw It or Drag & Drop activities to create their designs.

By integrating these conservation-themed activities into the classroom, students can gain a deeper understanding of the importance of protecting plants

and animals. This hands-on, real-world approach or participatory approach can inspire students to become environmental stewards and advocates for conservation in their communities.

5. Evaluate phase;

The last phase of the 5E instructional model is the Evaluate phase. This is where all learning comes together. Assessed students' understanding and evaluate student progress with scientific temper skills. In this phase, students can apply skills and concepts they have learned throughout the entire lesson and receive feedback about their learning. The 5E Model allows for both formal and informal assessment. During this phase, students can be observed to see whether they have a complete grasp of the core concepts. In this phase, students were asked a variety of questions, from broader, open-ended questions to discrete, direct questions. Also, students assess themselves. Using Nearpod, the strategies, such as Open-Ended Questions, Matching Pairs, Draw It, Drag and Drop, Quizzes, and Fill-in-the-Blanks were provided. They were also provided different methods to assess students' understanding and scientific temperament. Nearpod's Time to Climb, gasifies student assessment and motivates.

Image 8: *Students were nurturing a garden at school - Evolution phase.*

In explain phase, students were asked to give examples from real life situations apart from text books. To explain their understanding they were asked to create models or diagrams.

For evaluation in elaborate phase students were given opportunities of role play, projects, chart preparation and debates to apply what they have learned. Students were asked to grow gardens at school and home at real life applications.

Even though, it is said to be the last phase of the instructional model, evaluation was carried out in all the phases here and there for the sake of following continuous and comprehensive evaluation. But the investigator concentrated more to measure the scientific temperament and not on achievements. The pretest was conducted before starting the interventions to measure present level of scientific temperament. Finally, after intervention the post test was conducted to measure the improvement of scientific temperament among students. The pre and post tests were done using the tool which was created by the investigator with experts' discussion.

Image 9: *Students were listening to the lecture.*

11. DATA COLLECTION AND ANALYSIS

The investigator collected data from students by using the newly developed scientific temper scale. The investigator got prior permission from the head of experimental school.

This section presents the details of the analysis and interpretation to highlight the significance of the difference between mean scores of pretest and post test scores of Students on Scientific Temper. The changes between the pre-assessment and post-assessment score may be due to experimental treatment. The changes can be observed from the gain scores which is the difference between pretest and post test scores.

Scoring; For each and every response, maximum of 5 marks were awarded. In total 100 marks were allotted to measure the scientific temper.

In this study, the investigator computed the mean of the test score. Multiple comparisons were made.

Appropriate computing was done to find out the significant mean difference between assessment scores of students.

From the following table it could be understood;

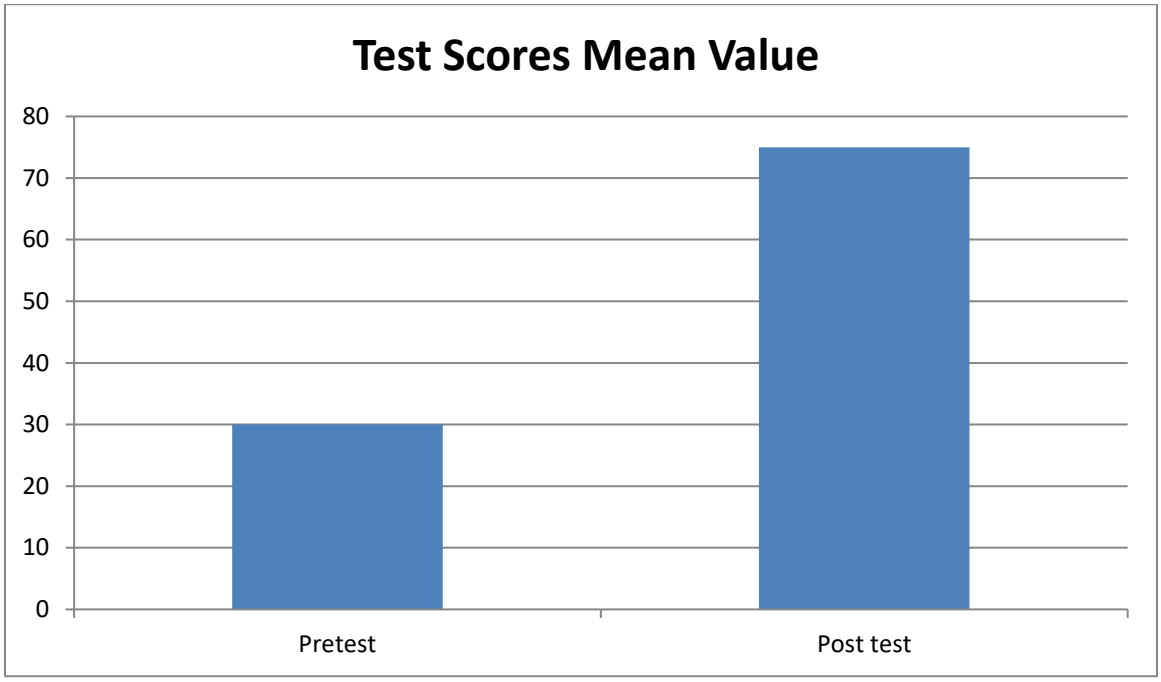
TABLE-1; Showing Assessment Scores

S.No	NAME	Pretest Score	Post test Score	Gain Score
1	SUBRAMANIAN. K	40	80	40
2	MOHAMMED SHAJITH.	25	85	60
3	SHANTHOSH. S	25	85	60
4	MOHAMMED SALMAN. J	25	80	55
5	ALIJUMOIL.S	10	75	65
6	MOHAMMED REHAAN.S	35	90	55
7	MOHAMMED SHERIEF.S	30	85	55
8	MOHAMMED HAFEEZ RAHMAN.M	25	80	55
9	MOHAMMED YAHYA.M	20	75	55
10	AHAMED SHAHITH.M	25	70	45
11	SHAHITHA. S	50	90	40
12	AYSHA SHITHIKA. S	35	90	55
13	JANISHA PARVEEN. S	30	85	55
14	SALMA AFRIN. J	20	85	65
15	DAHIRA SEERIN. V	45	90	45
16	HILMIYA. B	45	90	45
17	DHIVAN SHARMILA. S	50	85	35
18	APRAS PARVEEN. A	40	70	30
19	DHAS PEEKA. A	25	70	45
20	AYSHA NISHOFAR. I	25	65	40
21	ANISH FATHIMA. Y	10	50	40
22	HAMEETHA SEERIN. S	35	50	15
23	SYED ALI FATHIMA. S	30	60	30
24	KANISHKA. G	35	70	35
25	ATHIBA SABINA. M	25	65	40
26	PANDEESWARI. B	25	70	45
27	AFRIN SUBAITHA. S	15	55	40
28	MALAR. K	35	65	30
29	ASIYA SAHANI. M	30	60	30
30	HUSSAIN FATHIMA. N	35	80	45
	TOTAL	900	2250	1350
	AVERAGE	30	75	45

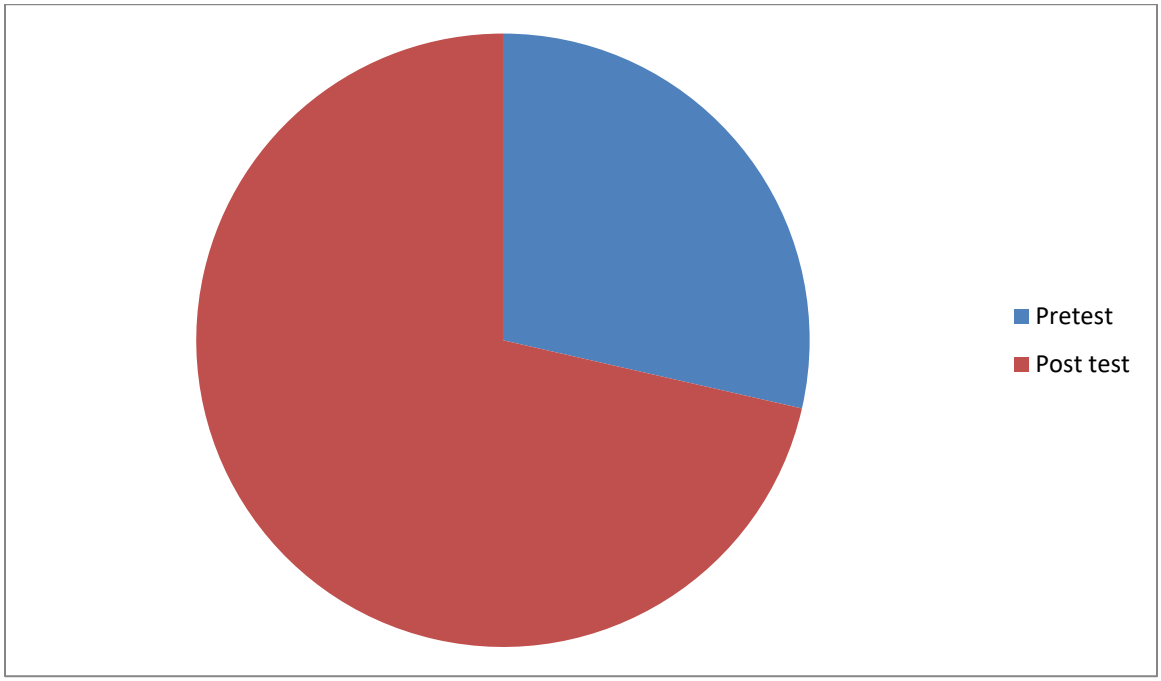
Comparison of Test Scores and Mean Value with respect to Intervention;

	PRETEST SCORE	POST TEST SCORE	GAIN SCORE
TOTAL	900	2250	1350
AVERAGE(MEAN)	30	75	45

BAR DIAGRAM SHOWING TEST SCORES MEAN VALUE



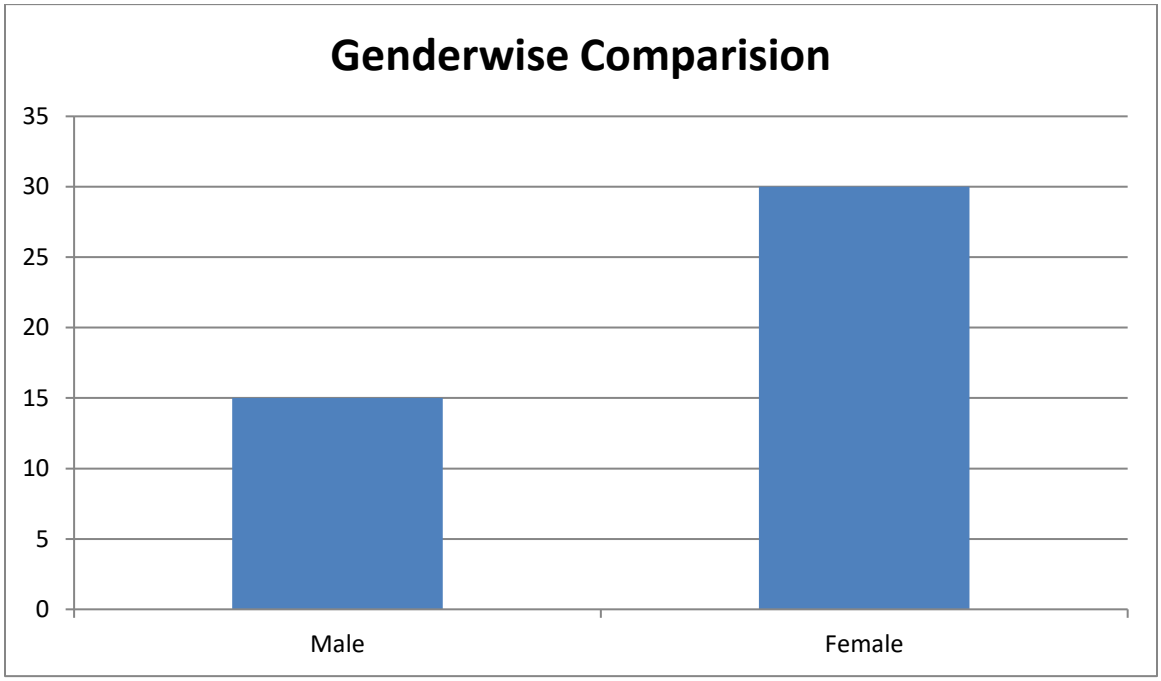
PIE CHART SHOWING TEST SCORES MEAN VALUE



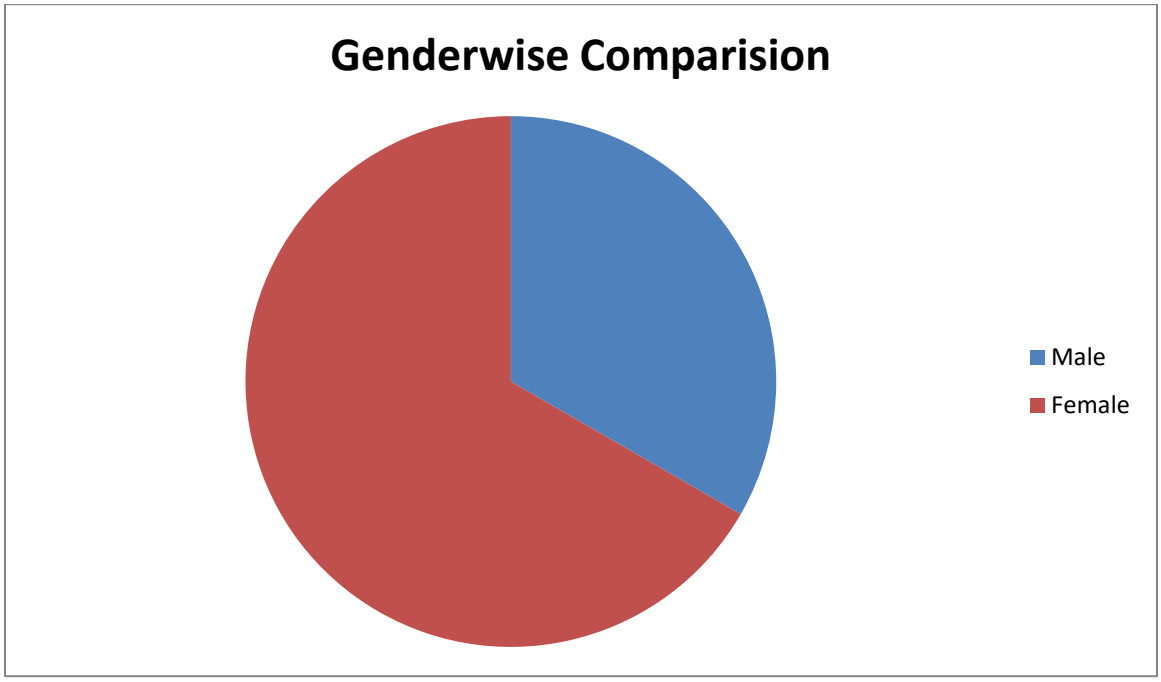
Comparision of Genderwise Scientific Temper Test Scores and Mean Value;

GENDER	GAIN SCORE TOTAL	GAIN SCORE AVERAGE
MALE	545	15
FEMALE	805	30
GENERAL	1350	45

BAR DIAGRAM SHOWING GENDERWISE COMPARISION



PIE CHART SHOWING GENDERWISE COMPARISION



12. FINDINGS

It is evident from the above Table, gain score mean value shows the significant difference between mean scores of pretest and post test scores of Students on Scientific Temper and hence the hypothesis "There will be significant improvement on Fostering Scientific Temperament among Standard Eight Students through Science Subject using Participatory Approach" stands accepted.

This finding is in contradiction to the results of the researches of Joshua, 2015; Amintarti et.al. , 2018; who found that the Male Secondary Students possess higher Scientific Temper than Female Secondary School Students. However, our results are in support to the results of Kapri 2017, who found Female Students possess more Scientific Temper than Male students.

There is significant improvement on Fostering Scientific Temperament among Standard Eight Students through Science Subject using Participatory Approach (Pretest mean score 30 & Post- test mean score 75, Gain score value 45).

Therefore, the inference can be drawn from figure-1 that Male and Female students differ significantly on scientific temper. Further, on the basis of mean scores (Table-1), it is clear that Female Students possess more Scientific Temper than Male Students.

13. CONCLUSION AND SUGGESTION

It was concluded that there is significant improvement on Fostering Scientific Temperament among Standard Eight Students through Science Subject using Participatory Approach.

The reason for higher Scientific Temper mean value to female students may be habit of coming to conclusions in light of evidences, reasons and logics.

Science teachers need to inspire the Scientific Temper among student community, as it is very much essential for the present-day scientific and technological world Such that students may be able to work better in such a way to adjust themselves in the fast developing scientific world of 21st century.

To encourage Scientific Temper among students' purposeful preparation of scientific activities such as arranging scientific discussions, taking students to science exhibitions, fairs, excursions, field trips, conducting research in a Novel way, allocating projects, give training to make improvised equipment which would be of use in day-to-day lives should be practiced.

Science education should focus on activities that support culture and the student's experience, which in one way or the other relates to their life's activities. By doing this, students will feel that their ideas/opinions are taken into account and are valued, which it will increase their self-concept in science. Emphasis should be made to make connection between science and student's life.

Awareness should be given about Scientific Temper and its importance in all round development and for nation building. Students should be encouraged to relate science knowledge and scientific method to solve real life situations.

In order to enhance Scientific Temper among Students specific and clear goal oriented curriculum is essential.

No matter how much scientific information exists, it contributes to the process of national development and social change.

Scientific Temper is essential for an individual to lead a smooth and comfortable life in the society.

Scientific temper help to understand the Why's and How's of life.

Scientific temper is a mental and cultural tradition that help to understand the why's and how's of life.

It preserves the traditional beliefs and without hampering man's curiosity about nature, the wonders of creation and origin of universe.

In order to enhance Scientific Temper among students specific and clear goal oriented curriculum is essential.

In view of our findings, future scopes are as follows:

The study helps to facilitate understanding students learning tendencies towards Science.

The study helps to enhance the use of technology supported learning methodology for all-round development of students and enhance their Scientific Temper.

After analyzing all sincere efforts done to inculcate scientific temper among students it seems to be very little amidst rising irrationality, intolerance and belief in superstitions.

This section presents the details of the analysis and interpretation to highlight the significance of the difference between mean scores of Male and Female Students on Scientific Temper.

Scientific Temper is necessary for an individual to lead a smooth and comfortable life in the society.

In order to enhance Scientific Temper among students specific, and clear goal oriented curriculum is essential.

Attempt should be made in the future to give more deliberation to include all the school subjects for this purpose and to provide strategies for its implementations including teachers' training and preparation of text books with more illustrations related to scientific thinking and temper.

It was felt that there is disconnection between science and society. Major stakeholders of education need to consider their accountability in this matter and provisions need to be done in this respect.

Even the recent NEP, 2020 has not discussed scientific temper in depth and used it superficially, although in draft NEP, 2019, a separate heading was assigned to it. The Palampur declaration, 2011 was the last policy specifically related to scientific temper which is too far back. The present situation demands a fresh policy focusing specifically scientific temper.

Curriculum should provide ample opportunities to the teachers to try and apply a variety of methods of teaching to suit the needs of learners of different backgrounds.

14. SUMMARY

The prime purpose of this study was to assess the level of scientific temperament of standard eight students of 8th ward municipal middle school, Rajapalayam.

The investigator, Mr., T. ELANGO, senior lecturer's approved action research title is, "Fostering Scientific Temperament among standard eight students using science subject through participatory approach" working at DIET, Palayampatti, Virudhunagar District, Tamil Nadu, India

This action research was aimed to measure and improve the scientific temperament among standard eight students of 8th ward municipal middle school, Rajapalayam, using science lesson (conservation of plants and animals) through participatory approach. For sample selection all the students studying in class eight were selected as a target group.

To collect data, a tool was created by the investigator with experts' discussion. The questionnaire was constructed with 20 statements of having five point scientific temper scale with levels of—Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree.

The experimental design (Pretest – Intervention – Posttest) was planned to carry out this action research. Regarding statistical techniques mean values of test scores were compared with gain score mean values to find out the effect of participatory approach on fostering scientific temperament among standard eight students.

Pre-test was conducted to know the performance (previous level of scientific temperament) of the students prior to exposure or interventions. Exposure or instructional program was given on conservation of plants and animals through

participatory approach. Then post-test was conducted to students after completion of an instructional program or interventions.

The data analysis and findings gives the positive results (Pretest score mean value- 30; Post score mean value- 75; Gain score mean value- 45) in the improvement of scientific temperament.

The obtained result may be due to the deviation or transition from conventional method to participatory approach in science class room teaching.

As a suggestion, this approach may fit to follow for other subjects, schools, and various levels.

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ANNEXURES

Action Research (2023-24) - Pre Test/Post Test **Questionnaire**

8th ward, Municipal Middle School, Rajapalayam.

Class VIII Marks – 100 Student Name;

S.No	Statement	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1	I enjoy exploring new ideas and concepts in conservation of forest.					
2	I often ask questions about the endangered species.					
3	I am curious to know the causes and effect for endangerment of extinct species.					
4	I am willing to consider new evidences on causes of bio magnifications.					
5	I listen to different viewpoints on activities of Blue cross before forming an opinion.					
6	I listen to different viewpoints in Causes of Bio-magnification before forming an opinion.					
7	I question scientific claims for maintaining healthy ecological balance.					
8	I evaluate scientific evidence critically before accepting effect of Global warming.					
9	I am cautious about believing everything I hear or read in effects of bio-magnification.					
10	I enjoy coming up with new ideas and solutions in Saving Endangered Species.					
11	I am imaginative and innovative when solving environmental problems.					
12	I like to think outside the box when conducting investigations on bio magnifications.					
13	I keep trying even when plantation projects in my village are challenging.					
14	I don't give up easily Blue Cross activities when faced with obstacles.					
15	I should follow plantation for the betterment of environment, even if it takes time.					
16	I believe CPCSEA is important for the betterment of animal protection.					
17	I follow ethical guidelines and safety					

	procedures when conducting Jallikattu functions.					
S.No	Statement	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
18	I consider the potential impact of Mobile Usage on people and the environment.					
19	I am motivated to take action to protect endangered species in my local environment.					
20	I am interested in participating in conservation initiatives.					

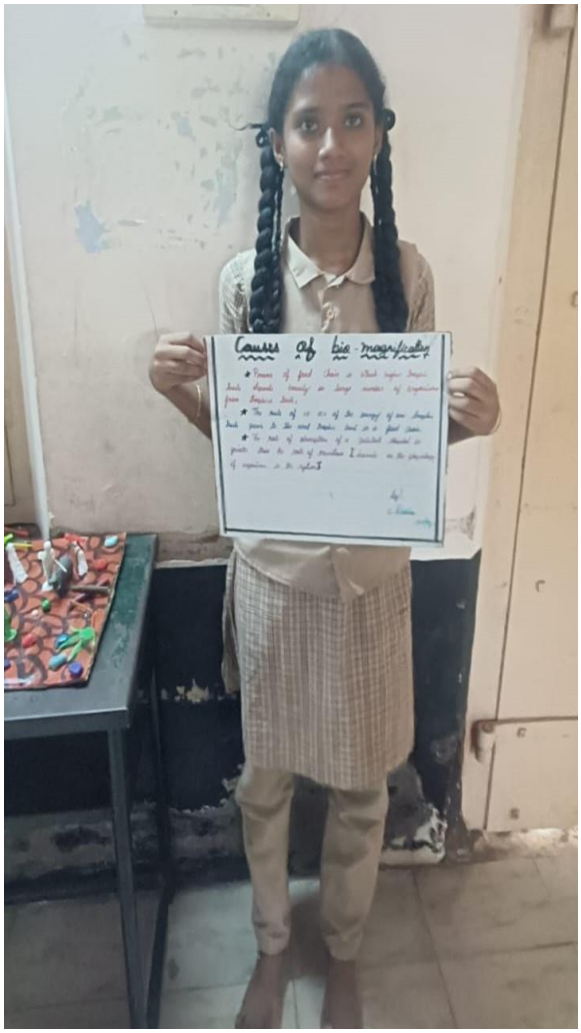
PHOTOS

Field Trip Visit To Sastha koil

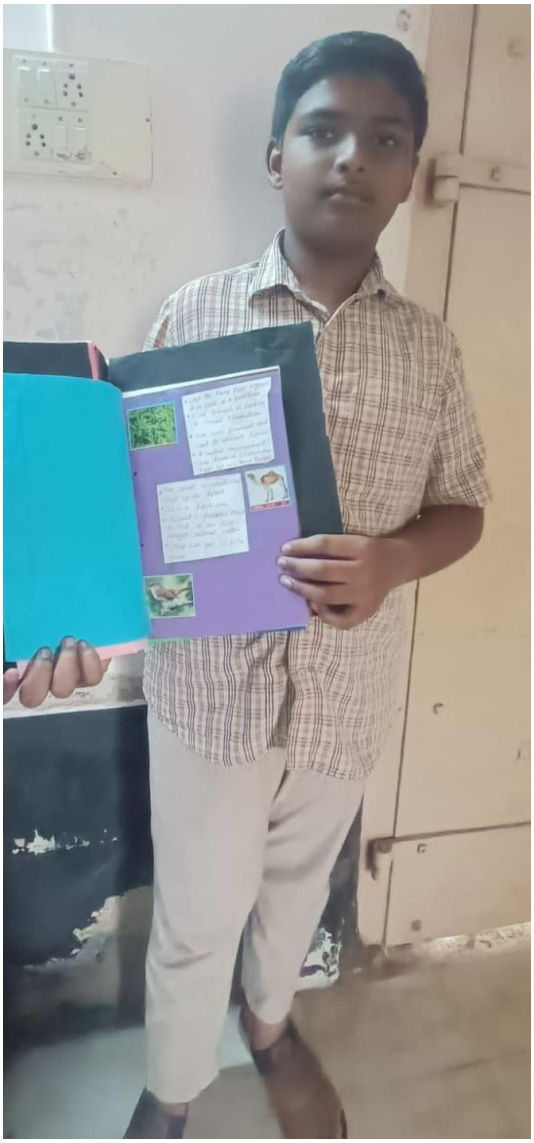
Visiting Dam

Drawing Animal Habitat

Group Member Presents Concepts



Album Preparation



Afforestation Model

C

Visiting Aquatic Habitat

Visiting Sastha Kovil Forest

ACTION RESEARCH ABSTRACT 2023 - 24

TN- VNR

1**. Name of the Investigator**; T. ELANGO, Senior lecturer,

2. **Name of the Institute**; DIET; PALAYAMPATTI

3**. Title**; Fostering Scientific Temperament among Standard Eight Students through Science Subject using Participatory Approach.

4. **Objectives**; To identify present level of scientific temperament and promote it among students.

To Foster the Scientific Temperament among Standard Eight Students through Science Subject using Participatory Approach

To Promote and help students learn science differently. Disseminate information on Action research dissemination workshop to teachers.

5**. Sample**; All the Students of Standard Eight from 8th ward Municipal middle school, Rajapalayam , are taken for the study. Student's medium of instruction is English medium.

6. **Tool;** The tool was the scientific temper five point rating scale which was developed by the investigator. Five point rating scale contains the statements taken from the lesson conservation of plants and animals.

But in this study, Scientific Temper dimensions such as 1.Curiosity, 2.Open mindedness 3.Scepticism, 4.Critical thinking, 5.Persistance, 6.Ethical responsibility, 7.Collaboration, were used to construct the tool.

7. **Methodology;** Pre-test, intervention, post-test model of Experimental method.

Single group experimental method was followed in this study.

Hence the students of whole class were included as a single group for this study.

The statistical measures such as Mean, and Average were applied to analyze the obtained raw scores for testing the hypothesis and drawing the inferences. Mean value found is used to compare the pretest and post test scores to see the effect of interventions.

8**. Findings**; The Post Test mean score(75) is higher than that of pretest mean score value(30)and it is evident for the promotion of scientific temperament among students of 8th standard. Hence, by shifting to the participatory approach, scientific temperament can be inculcated and improved among students.

Field Trip to Western Gates

Riddles Activity on Deforestation Effect

Viewing Blue Cross Activity Video

Post Test Conduction