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Science Education/ Environmental Education

1. Research Abstract

1. Theme/Subject:	Science Education/ Environmental Education
2. Stage of Education:	Preparatory, Middle and Secondary Stages, and Teacher Education.
3. Topic of Research:	Impact of Environmental Education on School-Going Children and Teachers / Community Members
4. Name and Address of the Investigator(s) with email:	Nighat Parveen, Dr. Rachna Gupta Convener Project Officer Tripta Charak (Member)
5. Name of the Institution where the Research was conducted	District Institute of Education and Training, Canal Road, Jammu – 180001.
6. Category: (Research study/Action research/ Other)	
7. Language of Research Report:	English
8. Year of Completion:	2022
9. Published/Unpublished:	

10. Introduction:

Environmental Education helps ensure the health and welfare of a Nation by addressing the basic environmental concerns. Environmentally aware and empowered students are among the greatest agents of long-term environmental protection.

Environmental Education plays a vital role in promoting responsible citizenship and encouraging sustainable development. In the context of increasing environmental challenges such as pollution, climate change and resource depletion, it is imperative to equip teachers, students and community members with adequate knowledge, positive attitudes, and proactive behaviour to protect the environment. Schools serve as vital platforms for nurturing environmental awareness, while teachers act as key facilitators in shaping learners' perspectives and practices. This study observes the impact of environmental education on school-going children, teachers and community members in Jammu District. It aims to evaluate participants' knowledge, attitudes, and levels of awareness about environmental pollution and conservation. By evaluating both cognitive and behavioural dimensions, the study highlights the transformative potential of environmental education in evolving environmentally conscious individuals who can contribute meaningfully to environmental sustainability and community well-being

11. Objectives:

- To study the impact of environmental education.
- To assess the level of knowledge of students regarding environmental pollution and protection.
- To assess the role of teachers in disseminating environmental education.
- To assess the level of awareness of teachers/community members.

12. Methodology:

I.Design of the study

This study is based on primary data collected by conducting a field survey through questionnaires.

II.Sample

In the present study, a stratified random sampling technique was used to select 89 government schools of Jammu District (primary, middle, High School (HS), Higher Secondary School (HSS) from 15 zones and 512 students and 359 teachers were selected.

Tools

Questionnaires were employed to collect data.

III. Procedure of data collection

A separate questionnaire titled "Impact of Environment Education" was used for school-going children as well as teachers/community members. For school-going children, a three-point Likert scale was used to elicit responses to ascertain the students' attitudes towards the environment. The format of the three-level Likert scale is: 1. Agree 2. Disagree 3. Neutral

For teachers/community members, the questionnaire was divided into two sections (A and B). Section A was used to elicit responses on the respondent's knowledge towards the environment while section B, which was a three point-Likert scale, was used to elicit responses to ascertain the teachers'/community members' attitude towards the environment. A three-point Likert scale offers agree and disagree as to the farthest points along with a neutral option. The researchers administered the questionnaires personally. Thereafter a face-to-face method was adopted to make sure that the respondent filled the questionnaire effectively.

IV. Data Analysis

Based on the responses obtained from school-going children and teachers/community members, inferences have been drawn and displayed with the help of Pie Charts.

13. Findings:

The present study revealed that:

(i) The positive impact of environmental education on participants, 80% was observed with noticeable changes in attitude and behaviour towards environmental issues.
(ii) 40% of respondents know environmental issues. 60% of respondents showed interest in taking action to protect the environment.
(iii) Participants exhibited varying levels of knowledge regarding environmental pollution and protection.
(iv) Teachers played a crucial role in disseminating environmental education, acting as key influencers on students' attitudes and behaviour.
(v) Revealing variations in the level of awareness of teachers/community members in understanding and commitment to environmental issues.

14. Implications:

The study was conducted to learn about the importance of reducing waste, conserving energy, and preserving natural resources. Such a study helps to reduce the impact of human activities on the environment and promote sustainability.

Suggestions:

- There should be full and effective implementation of environmental education into the school system.
- There should be effective cooperation between national and local organisations dealing with environmental promotion.
- Educators need to develop and implement effective environmental education programs that promote positive attitudes and values towards the environment.
- Environmental education programs need to be tailored to the specific needs and interests of different age groups. Community members need to be involved in environmental education initiatives.
- The study suggests further research is needed to identify the most effective methods for teaching environmental education. There is a need to prepare an action plan to increase students' environmental awareness.

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16. Keywords: Environmental Education, Environmental Awareness, Sustainable Development, School Education, Teacher Role, Community Participation

2. Research Abstract

1. **Theme/Subject:**	Science Education/ Environmental Education
2. Stage of Education:	Middle and Secondary Stages
3. Topic of Research:	Intervention to Achieve quality learning in science in selected schools in ST dominated districts of Nagaland:A Case Study
4. Name and Address of the Investigators(s) with email:	Dr Sharad Sinha
5. Name of the Institution where the Research was conducted	NCERT
6. Category: (Research study/Action research/Other)	Research Study
7. Language of Research Report:	English
8. Year of Completion:	2018-2020
9. Published/Unpublished:	Unpublished

10. Introduction:

The North-Eastern region of India is distinguished by its hilly terrain, scenic rivers, mountains, rich biodiversity, and unique cultural heritage. This region, comprising Sikkim, Tripura, Nagaland, Mizoram, Manipur, Meghalaya, and Arunachal Pradesh, is renowned for its rich ethnic diversity, vibrant festivals, and diverse linguistic heritage. Geographically, it shares international boundaries with Nepal, China, Myanmar, and Bangladesh, which further contribute to its cultural exchanges and external influences. While the region has preserved its traditional practices and indigenous heritage, contemporary developments have also shaped its socio-cultural and educational landscape. Nagaland, one of the important states of the North-East, reflects these dynamics through its education system. Schools in the state are administered by the state government, the central government, and private organisations, with English serving both as the medium of instruction and the official language. The state records a literacy rate of 80.1 per cent, reflecting significant progress in educational attainment. Following the 10+2+3 structure, students completing higher secondary education may pursue general or professional degree programs. The interplay of tradition and modernity in Nagaland's educational framework highlights both opportunities and challenges, situating the state within the broader discourse on the development of education in the North-Eastern region of India.

11. Objectives:

- Assessment of baseline situation in the selected schools, in terms of students' achievement, resource availability, and teacher competencies in learning of science.
- To identify the factors responsible for the low performance of the students in science.
- Designing interventions to achieve quality learning in science.
- Study the effect of interventions on the learning of science among secondary school students.

12. Methodology:

The study adopted a descriptive survey design with a mixed-methods approach to examine science learning in secondary schools of Nagaland, particularly in Zunheboto district. Schools were purposely selected based on students' performance in the National Achievement Survey (NAS) and state examination results. The sample consisted of 333 students of class IX, 16 science teachers (trained and untrained), and 11 headmasters from 11 government secondary schools. A range of tools was developed and finalised in workshop mode involving subject experts, teachers, and state officials. These included: (i) an achievement test in science (20 multiple-choice questions) for students, (ii) a 25-item competence test for teachers assessing pedagogical knowledge, content mastery, and integration of technology, (iii) classroom observation schedules, (iv) questionnaires and checklists for assessing resource availability, and (v) focus group discussion guides for students, teachers, and headmasters. Data collection involved classroom observations, interviews, and surveys, supplemented by focus group discussions. Both qualitative and quantitative analyses were employed. Baseline data on student achievement, teacher competence, and resource availability informed the design of targeted interventions, which included workshops, content enrichment activities, and pedagogical training. A post-test was administered after interventions to evaluate their effectiveness and to finalise a framework for improving science education.

13. Findings:

The study revealed significant gaps in science learning outcomes among secondary school students in Zunheboto district, Nagaland. Out of 333 class IX students tested, 79.6 per cent demonstrated low performance (0–34%), 20.4 per cent showed average performance (35–60%), and none achieved high performance. Teacher competency assessments also highlighted critical deficiencies: while some teachers displayed moderate pedagogical knowledge and conceptual

understanding, most showed weak content knowledge, limited use of teaching-learning materials, poor integration of technology, and inadequate assessment practices. Classroom observations further corroborated these findings. Only a small proportion of teachers engaged students in active learning, encouraged hands-on experiences, or facilitated inquiry-based learning. Feedback mechanisms were largely limited to verbal remarks, with minimal written evaluation. Resource management was found to be poor, with science laboratories either non-existent or inadequately equipped. Most schools lacked essential teaching aids, laboratory manuals, functional equipment, and access to multimedia or ICT resources. The analysis of school environments showed that while classrooms often maintained a democratic and learner-friendly atmosphere, infrastructural and resource limitations severely constrained effective science teaching. Overall, the findings underscore a pressing need for systematic interventions targeting teacher training, resource enhancement, and student-centred pedagogical practices to improve science learning outcomes in the region.

14. Implications:

The findings of the study carry several important implications for strengthening science education in Nagaland. At the pedagogical level, the low achievement of students and weak teacher competencies highlight the urgent need to shift classroom practices from rote methods to activity-based and inquiry-oriented learning. Teachers require continuous professional development to enhance subject knowledge, improve pedagogy, and integrate assessment practices that go beyond verbal remarks. The provision of structured training and mentoring can enable teachers to use locally available resources more effectively and make science learning engaging and meaningful.

At the policy level, the lack of well-equipped laboratories, teaching aids, and ICT resources suggests that systematic investments in school infrastructure are essential. Policies must ensure equitable distribution of resources, especially in rural and remote areas, to bridge disparities. Moreover, curriculum planning should align with competency-based learning and encourage practical work, project activities, and contextual examples to deepen understanding. Systemically, the study indicates the need for stronger governance, monitoring, and school leadership to sustain improvements. Empowering headmasters, strengthening school management committees, and ensuring accountability can help address gaps in implementation. Taken together, these implications stress the importance

of integrated reforms in pedagogy, infrastructure, and governance to enhance the quality of secondary science education in Nagaland.
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16. Keywords: Science Pedagogy; Teacher Competence; Student Achievement; Learning Resources; Infrastructure Gaps; Educational Reform

3. Research Abstract

1. **Theme/Subject:**	Science Education/ Environmental Education
2. Stage of Education:	Secondary Stage
3. Topic of Research:	A Study of Use of Science Laboratories in Government Secondary Schools of Meghalaya (PAC 25.17 of 2016-17)
4. Name and Address of the Investigators(s) with email:	Mr. Arnab Sen, Assistant Professor, NERIE, Umiam
5. Name of the Institution where the Research was conducted	NERIE, Shillong. Data collected from the sampled secondary schools of Meghalaya
6. Category: **(**Research study/Action research/Other)	Research study
7. Language of Research Report:	English
8. Year of Completion:	2017
9. Published/Unpublished:	Published

10. Introduction:

Science education at the secondary stage is expected to combine theory with practice, enabling students to develop scientific skills, inquiry, and problem-solving abilities. For this, laboratory facilities play a crucial role. However, national surveys, including the All India School Education Survey (AISES), have repeatedly shown that many schools either lack laboratories or have inadequate facilities, particularly at the secondary stage.

In Meghalaya, science is taught as an integrated subject, but there is limited information on the availability, adequacy, and utilization of laboratories. It remains unclear whether schools' function with a common science laboratory or separate laboratories for physics, chemistry, and biology. The situation is further complicated by rural–urban disparities, with urban schools generally better equipped than rural ones. Home Science laboratories are almost absent.

This gap is critical because Meghalaya, being a hilly and geographically challenging state, needs strong science education to nurture innovation and

prepare its youth for higher education and careers in science and technology. Poor infrastructure may restrict students' exposure to practical science, leading to rote learning. Against this backdrop, the present study was undertaken to examine the availability and adequacy of science laboratories in Meghalaya secondary schools, assess disparities, and highlight areas requiring urgent policy attention.

11. Objectives:

The present study was designed to investigate the status and utilization of science laboratories in government secondary schools of Meghalaya. The research was guided by three research questions: (i) What proportion of government secondary schools in Meghalaya have science laboratories? (ii) To what extent are the facilities available in these laboratories adequate for effective science teaching and learning? and (iii) How are these laboratories actually being used by teachers and students in the classroom process?

In line with these questions, the study had four specific objectives. First, to identify government secondary schools in Meghalaya that are equipped with science laboratories. Second, to examine the nature and extent of facilities available in these laboratories, with reference to adequacy for secondary-level science education. Third, to study how teachers and students make use of laboratory spaces and resources as part of their teaching–learning practices. Finally, based on the findings, to suggest appropriate measures for improving the availability, adequacy, and utilization of laboratory facilities in government secondary schools of the state. These objectives not only shaped the research design but also ensured that the study addressed both infrastructural and pedagogical dimensions of science education.

12. Methodology:

The study was conducted in 5 government secondary schools of Meghalaya, selected randomly from both rural and urban areas. The sample comprised schools, science teachers, and students. All science teachers from the selected schools were included, while 8–12 students were purposely chosen from each school to participate in the study.

Multiple tools were developed and adapted for data collection. A School Information Schedule was used to document infrastructure and availability of laboratory facilities. For teachers, two types of Interview Schedules were designed, one for schools with laboratories to gather data on usage, adequacy, and challenges, and another for schools without laboratories to understand

perceptions, strategies, and alternative practices used in science teaching. For students, Focus Group Discussion (FGD) guidelines were prepared separately for schools with and without laboratories to explore their experiences, satisfaction, and expectations. In addition, a Laboratory Observation Checklist was used to systematically record the facilities, equipment, and safety measures present in laboratories.

Tools previously developed by RMSA for the study "Availability and Utilization of Laboratory Facility for Teaching-Learning Science at Secondary Level" were also referred to and adapted for contextual use in this study.

13. Findings:

The study revealed that while some government secondary schools in Meghalaya reported the presence of science laboratories, their actual use in teaching at the secondary stage (Classes IX–X) was minimal. Laboratory classes were largely absent, except for a few isolated instances, and most labs were in poor condition. In one rural school, the room meant for the laboratory was used as storage space. By contrast, laboratories in higher secondary sections were relatively better equipped, yet students at the secondary level were seldom taken to these facilities.

Though in some NCERT laboratory manuals and science kits were available, effective use of these didn't take place, as teachers rarely incorporated them into classroom practices. Observations indicated weak classroom management during laboratory periods and limited conceptual clarity among teachers. Most teaching continued to rely on traditional methods using chalk, blackboard, and textbooks, with negligible use of teaching-learning materials or equipment.

A clear disparity was observed between urban and rural schools. Urban schools had comparatively better infrastructure and access to equipment, but usage remained low. Rural schools often lacked adequate facilities altogether. The student–teacher ratio also varied significantly between government and private schools, affecting laboratory-based learning.

14. Implications:

The findings of the study highlight critical implications for strengthening science education in Meghalaya. The mere presence of science laboratories does not ensure their use in teaching–learning. Most secondary students, particularly in Classes IX and X, are deprived of meaningful laboratory experiences, which limits their ability to apply scientific concepts and develop inquiry skills. This gap

undermines the objectives of competency-based learning emphasized in national frameworks.

There is a need for systematic teacher capacity-building to improve conceptual clarity, confidence, and classroom management in conducting laboratory activities. Teachers must also be trained in the effective use of NCERT science kits, manuals, and low-cost teaching aids so that practical science becomes an integral part of learning.

Infrastructure gaps between urban and rural schools require attention. While urban schools often have laboratories that are poorly used, many rural schools lack adequate facilities altogether. Investment in laboratory spaces, equipment, and maintenance in rural areas will help reduce this disparity and improve the science learning experience.

School monitoring and academic support structures should emphasize the integration of lab work into regular classroom processes. Policies under initiatives like Rashtriya Avishkar Abhiyan (RAA) should be localized to ensure that Meghalaya's students gain equitable access to inquiry-based, hands-on science education.

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16. Keywords: Laboratory, secondary school, NCERT science kit, NCERT Lab Manual

4. Research Abstract

1. Theme/Subject:	Science Education/ Environmental Education
2. Stage of Education:	All stage
3. Topic of Research:	Green Education: Exploration of local Plant biodiversity used as Green leafy vegetables in Tribal areas of Odisha
4. Name and Address of the Investigator(s) with email:	Prof. M.K. Satapathy E-mail Id: mksatapathy@rediffmail.com
5. Name of the Institution where the Research was conducted	Regional Institute of Education, Bhubaneswar
6. Category: **(**Research study/Action research/Other)	Research Study
7. Language of Research Report:	English
8. Year of Completion:	2018
9. Published/Unpublished:	Unpublished

10. Introduction:

Biodiversity represents the sum total of all plants, animals and microbial life on the planet Earth. This diversity of living creatures has been used by each civilization for growth and development as a support system. The rich biodiversity has been instrumental in providing humanity with food security, shelter, health care and to some extent industrial goods leading to high standard of living in the modern world. Further, biodiversity is the very stuff that supports the evolution and differentiation of various species. It sustains the bodies we live in and affects the lives we lead and the societies we form. With urbanization and developments in Science and Technology, present generation students are more engaged in computers, mobile phones, internet, video games, etc. rather than going to parks and gardens. As they are away from nature, they have little or no concern for it. The indigenous knowledge gathered over the years is slowly eroded. Interestingly, the UNO has declared 2011-2020 as the decade of biodiversity conservation in order to create awareness about biodiversity, its importance and conservation. Under this background, the present study was conceptualized to study plants and their parts used by tribal people for games and joy in order to create love for plants, promote aesthetic values and to conserve this indigenous knowledge.

11. Objectives:

- To study and identify plant species being used as green leafy vegetables from local biodiversity.
- To document the information for future use.
- To give suggestions for the propagation and conservation of selected plant species.

12. Methodology:

The study was conceptualised to study plants and their parts used by tribal people for games and joy in order to create love for plants, promote aesthetic values and to conserve indigenous knowledge. The study was initiated with a questionnaire prepared with the help of experts and distributed among teachers and community members of Koraput and Nabarangpur districts to find out plants and their parts being used for games and joy. On the basis of the information received, plants were collected and identified with the help of flora books. The pictures and photographs from the plant and plant part were taken and has been depicted with description of the plant species and its nature of use in the present report. The following methods were used.

- The survey method was used in the present study
- Questionnaire & collection of information from elderly people & teachers (Sample size: 200)
- Identification of plants
- Search of nutritive value, through literature survey
- Documentation of Information and indigenous knowledge
- Preparation of Report and Resource book

13. Findings:

It was found out in the research study that through games and joyful learning in schools local plant biodiversity can be explored and green education can be imparted in tribal schools of Odisha.

- Lady's finger is usually used as a vegetable for cooking purpose.
- Indian liquorice use seeds for making necklace because of its attractive colour.
- Indian mallows are circular in shape consisting of hairy carpels on it.
- A red hot cat's tail is long and deep red in colour that looks attractive and appears like a cat's tail.
- The prickly chaff flowers of the plant are very thin. Children use the leaves as crackers by folding the leaves inside the palm.
- Red Lucky Seeds are rounded and deep red in colour which looks very attractive.
- Sola pith plant stem has the lightest wood of all.

Similarly many other plants were taken as species and the usefulness of parts of these plants were explored in this study.

14. Implications:

The indigenous knowledge gathered in this report shall be useful for teachers in order to organise joyful learning activities inside and outside the classroom besides sensitizing them for nature conservation. A resource book was distributed to SCERT Odisha and other Institutions to create awareness on green education among tribal schools of Odisha.

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16. Keywords: Green Education, local plant biodiversity, games and joyful learning, tribal schools.

5. Research Abstract

1. Theme/Subject:	Science Education/ Environmental Education
2. Stage of Education:	Secondary Stage
3. Topic of Research:	A Study of Effectiveness of Atal Tinkering Labs in promoting innovation and entrepreneurship among secondary school students
4. Name and Address of the Investigators(s) with email:	Dr. Shivalika Sarkar
5. Name of the Institution where the Research was conducted	RIE Bhopal
6. Category: (Research study/Action research/Other)	Research Study
7. Language of Research Report:	English
8. Year of Completion:	2024-25
9. Published/Unpublished:	Unpublished

10. **Introduction:**

Atal Tinkering Lab (ATL) initiative under the Atal Innovation Mission aims to foster creativity, innovation, and 21st-century skills among students across India. Secondary school education plays a crucial role in equipping learners with the necessary cognitive, problem-solving, and collaborative skills required for the modern world. The integration of ATL into the school curriculum is intended to promote hands-on learning, experimentation, and application of knowledge through a structured yet flexible learning environment. The Western Region, with its diverse school systems and student populations, provides a unique context to assess the effectiveness of ATL in achieving its intended objectives. Despite widespread implementation, there is a need to systematically study the status of ATL usage, its impact on students' learning outcomes, and its role in nurturing key 21st-century competencies such as critical thinking, creativity, collaboration, and communication. Additionally, understanding the strengths, weaknesses, opportunities, and challenges (SWOC) associated with ATL implementation can inform best practices and policy decisions. This study seeks to evaluate the effectiveness of ATL in secondary schools, explore implementation patterns, and provide actionable insights to enhance the ATL Sarthi Scheme, thereby ensuring that innovation-driven learning reaches every learner in the region.

11. **Objectives:**

- To study the status of implementation and usage of Atal Tinkering Labs (ATL) in Secondary Schools of the Western Region.
- To assess the effectiveness of ATL in enhancing the achievement of learning outcomes among Secondary School students.
- To evaluate the role of ATL in promoting key 21st-century skills, including creativity, critical thinking, collaboration, and communication, among Secondary School students.
- To explore the strengths, weaknesses, opportunities, and challenges (SWOC) associated with the implementation of ATL in Secondary Schools.
- To identify best practices and innovative approaches associated with ATL in Secondary Schools.
- To suggest a comprehensive framework for improving the implementation and functioning of ATL in Secondary Schools.
- To provide evidence-based recommendations and inputs for enhancing the ATL Sarthi Scheme for effective innovation-driven learning.

12. **Methodology:**

The study adopts a **mixed-method research design**, combining both quantitative and qualitative approaches, following an explanatory sequential design. The **quantitative component** employs a descriptive survey method to assess the status, effectiveness, and outcomes of ATL implementation in Secondary Schools of the Western Region. Schools with functional ATLs, their teachers, and students constitute the primary sample. Quantitative data were collected through structured **questionnaires, checklists, and lab observation schedules**, focusing on infrastructure, learning resources, usage patterns, and student achievement in key learning outcomes.

The **qualitative component** involves a case study approach to explore the deeper perspectives of stakeholders. **Interview schedules** were administered to school heads and teachers associated with ATL, while **focus group discussions** were conducted with students using ATL to understand experiences, engagement, challenges, and innovative practices. Documentary analysis of school reports, ATL activity logs, and learning outcome records were supplement primary data.

Data was analyzed using **triangulation**, integrating quantitative metrics with qualitative insights to identify patterns, strengths, weaknesses, opportunities, and challenges in ATL implementation.

13. **Findings:**

The study revealed several significant insights regarding the implementation and impact of ATL (Atal Tinkering Labs) in Secondary Schools of the Western Region.

1. **Status and Infrastructure:** Most schools had well-established ATL infrastructure, including basic lab equipment, kits, and digital tools. However, some schools reported limited resources and inadequate maintenance, which affected effective utilization.
2. **Learning Outcomes:** ATL contributed positively to the achievement of subject-specific learning outcomes, particularly in science, mathematics, and design thinking. Students demonstrated improved problem-solving skills, analytical thinking, and practical application of theoretical concepts.
3. **21st Century Skills:** Participation in ATL activities enhanced creativity, critical thinking, collaboration, and communication among students. They showed higher engagement, motivation, and confidence in undertaking innovative projects.
4. **SWOC Analysis:**
   - **Strengths:** Active student participation, hands-on learning, teacher enthusiasm, and innovative project culture.
   - **Weaknesses:** Limited teacher training in advanced tools, inconsistent resource availability, and time constraints in regular school schedules.
   - **Opportunities:** Scope for integrating ATL learning with the mainstream curriculum, collaboration with industry, and inter-school competitions.
   - **Challenges:** Digital illiteracy among some teachers, maintenance of lab equipment, and ensuring equitable access for all students.
5. **Best Practices:** Schools with structured schedules, regular mentorship, and project documentation showed better outcomes. Collaborative learning, peer mentoring, and community engagement enhanced the impact of ATL

14. Implications:

The findings of the study highlight several important implications for policymakers, educators, and school administrators regarding the effective implementation of Atal Tinkering Labs (ATL) in Secondary Schools. First, enhancing teacher capacity through regular training programs is crucial, particularly in advanced tools, digital literacy, and hands-on project facilitation. Well-trained teachers can better guide students in innovation and critical thinking. Second, the integration of ATL activities with the mainstream curriculum can ensure that experiential learning complements theoretical knowledge, thereby reinforcing subject concepts while fostering 21st-century skills. Third, ensuring equitable access to ATL resources is essential; schools should address resource limitations and maintenance issues to provide all students with equal opportunities to engage in tinkering and innovation. Fourth, structured mentorship programs, peer learning, and collaborative projects should be

encouraged, as these strategies were linked to higher student engagement and learning outcomes. Fifth, documenting student projects and sharing best practices across schools can foster a culture of innovation and continuous improvement. Finally, policymakers can leverage these insights to refine the ATL Sarthi Scheme, focusing on resource allocation, teacher support, and monitoring mechanisms. Overall, the study underscores the transformative potential of ATL in nurturing creativity, problem-solving, and holistic development among students.

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16. Keywords: Atal Tinkering Labs, Secondary Education, 21st Century Skills, Experiential Learning, Innovation, Teacher Training

6. Research Abstract

1. **Theme/Subject:**	Science Education/ Environmental Education
2. Stage of Education:	Secondary Stage
3. Topic of Research:	A Study of Factors contributing to the achievement in Science of Secondary school students in the state of Maharashtra
4. Name and Address of the Investigators(s) with email:	Dr. D.M. Parmar
5. Name of the Institution where the Research was conducted	RIE Bhopal
6. Category: (Research study/Action research/Other)	Research Study
7. Language of Research Report:	English
8. Year of Completion:	2020-21
9. Published/Unpublished:	Unpublished

10. **Introduction:**

Science education plays a pivotal role in developing learners' understanding of natural and physical phenomena, fostering critical thinking, and preparing students for a knowledge-driven world. In India, concerns about students' performance in science have prompted large-scale assessments like the National Achievement Survey (NAS) conducted by NCERT. NAS is a competency-based assessment that evaluates students' learning outcomes, incorporating questionnaires for students, teachers, and schools. The 2019-20 assessment covered 2.2 million students from 1,10,000 schools across 701 districts in all 36 states and UTs, providing insights to guide policy, planning, and classroom practices. Despite these efforts, the performance of students in sciences, particularly at the secondary and senior secondary levels in Maharashtra, remains a concern. Identifying learning difficulties, common mistakes, and contributing factors are essential to improve science education quality. Previous attempts, such as the development of Minimum Levels of Learning (MLLs) and subject-wise competencies at the primary level, have not extended sufficiently to secondary education. This study seeks to assess the achievement of secondary school students in science in Maharashtra, analyze factors influencing their performance, and develop targeted interventions for teachers. By addressing learning gaps through structured

training and orientation programs, the study aims to enhance students' scientific understanding and overall academic achievement.

11. **Objectives:** The primary objective of this study is to assess the achievement levels of secondary school students in science in the state of Maharashtra and to identify the factors that influence their learning outcomes. Specifically, the study aims to evaluate the status of students' performance through standardized achievement tests in science, identifying learning difficulties and common errors that impede conceptual understanding. Another objective is to analyze the classroom processes, teaching strategies, and instructional methods employed by science teachers to determine how these affect students' learning outcomes. The study also seeks to examine the influence of socio-economic status, school locality, type of school (government or aided), and other contextual factors on students' achievement in science. Based on the identified learning gaps or "hot spots," the study intends to develop a comprehensive training package for science teachers, focusing on remedial strategies and effective pedagogical interventions. Furthermore, the study aims to organize orientation programs for Key Resource Persons (KRPs) in Maharashtra to facilitate the dissemination and implementation of the developed module, thereby strengthening the capacity of teachers to address students' learning challenges. Ultimately, the study seeks to provide actionable insights to enhance science education, improve teaching practices, and ensure that students achieve higher levels of understanding and application of scientific concepts.

12. **Methodology:**

The study adopts a mixed-method research design, combining both quantitative and qualitative approaches to provide a comprehensive understanding of secondary school students' achievement in science in Maharashtra. The sample consists of Class IX students from 15 government secondary schools spread across five districts of the state. Data collection involves multiple tools to capture different dimensions of learning and teaching processes. Students' achievement in science is measured using standardized tests to identify learning difficulties and conceptual gaps. Classroom observation schedules are employed to examine teaching-learning processes, including instructional strategies, use of resources, and student engagement. Teacher interviews are conducted to gather insights on factors affecting students' learning, classroom challenges, and pedagogical practices. Additionally, Focus Group Discussions (FGDs) with teachers, students, school management, and parents have been conducted to triangulate the information and understand contextual influences such as socio-economic status, school type, and locality. Quantitative data from tests and observations have been

analyzed using statistical methods, including mean scores, percentages, and comparative analysis. Qualitative data from interviews and FGDs have been analyzed through thematic and narrative inquiry. Based on the findings, a training package was developed for science teachers, and orientation programs for Key Resource Persons (KRPs) were organized to facilitate the implementation of remedial and innovative teaching strategies in classrooms.

13. Findings:

The study revealed that the overall achievement of Class IX students in science across the selected schools of Maharashtra was below the expected competency levels. Analysis of the achievement tests indicated that students struggled particularly with conceptual understanding, application of scientific principles, and problem-solving in experimental contexts. Gender-wise performance showed minor variations, with boys slightly outperforming girls in certain sections, though overall disparities were not significant. Classroom observations highlighted limited use of interactive and student-centered teaching strategies, with many teachers relying heavily on lecture-based instruction and textbook explanations. The integration of practical experiments and hands-on activities was inconsistent, leading to weak conceptual clarity among students. Interviews with teachers indicated several contributing factors, including inadequate professional training, large class sizes, lack of teaching aids, and limited time for individualized attention. FGDs with students and parents corroborated these findings, revealing low engagement, motivation, and insufficient support for self-directed learning. Socio-economic conditions and school infrastructure also played a significant role in influencing learning outcomes. Based on these findings, specific "hot spots" were identified—key areas of learning difficulty—which informed the development of a targeted training package. This package aims to enhance teachers' pedagogical skills, implement remedial measures, and improve overall student achievement in science at the secondary school level.

14. Implications:

The findings of this study have important implications for improving science education at the secondary school level in Maharashtra. Firstly, the identification of learning difficulties and "hot spots" provides a clear roadmap for designing targeted teacher training programs. Such programs can focus on strengthening conceptual understanding, practical application, and problem-solving skills in science, ensuring teachers are better equipped to address students' gaps. Secondly, the study highlights the role of Key Resource Persons (KRPs) as facilitators in

cascading effective teaching strategies to schools. Orienting KRPs on remedial measures and innovative pedagogical techniques can enhance the overall quality of science instruction. Thirdly, the study emphasizes the integration of socio-economic and contextual factors into teaching practices. Awareness of the influence of school locality, type, and students' socio-economic backgrounds can help teachers adopt more inclusive and differentiated instructional strategies. Furthermore, the use of mixed-method assessment tools, such as classroom observations, achievement tests, and focus group discussions, provides a model for continuous monitoring and evaluation of learning outcomes. Finally, the development of a training module based on identified learning gaps ensures systematic interventions, enabling students to achieve higher learning outcomes in science. Overall, the study supports evidence-based policy and practice to enhance student achievement and strengthen science education in Maharashtra.

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16. Keywords: Science Education, Secondary Students, Achievement, Learning Difficulties, Teacher Training, Maharashtra

7. Research Abstract

1. **Theme/Subject:**	Science Education/ Environmental Education
2. Stage of Education:	Secondary Stage
3. Topic of Research:	Effectiveness of Training Programme on the Use of Secondary Science Kits at School Level
4. Name and Address of the Investigators(s) with email:	Dr.R.P. Prajapati
5. Name of the Institution where the Research was conducted	RIE Bhopal
6. Category: (Research study/Action research/Other)	Research Study
7. Language of Research Report:	English
8. Year of Completion:	2020-21
9. Published/Unpublished:	Unpublished

10. Introduction:

Science education is essential for developing learners' understanding of natural and physical phenomena, fostering critical thinking, and promoting holistic development. In modern education, practical skills are as important as theoretical knowledge, as they help students connect abstract concepts with real-life experiences. The National Curriculum Framework (NCF) 2005 emphasizes that teachers should act as facilitators, encouraging students to explore, analyze, and construct their own understanding rather than merely memorizing content. Laboratories and hands-on experiments provide opportunities for students to investigate hypotheses, test ideas, and draw conclusions, thereby enhancing both conceptual clarity and scientific temperament. However, despite the inclusion of activities in science textbooks, many practical exercises are either inadequately performed or skipped in classrooms, limiting experiential learning. To address this, training programs using science kits have been introduced to equip teachers with the skills and confidence to conduct systematic experiments. Such programs aim to improve the effectiveness of science teaching by fostering active learning, critical thinking, and curiosity among students. This study focuses on secondary school students of Madhya Pradesh and Chhattisgarh, examining the impact of science kit-based training on learners' achievement, engagement, and attitude toward science. The findings are expected to provide insights into enhancing practical science education and improving teaching-learning strategies across schools.

11. Objectives: The primary objective of this study is to examine the effectiveness of a training program on the use of science kits at the secondary school level and to assess its impact on students' learning outcomes in science. Specifically, the study aims to evaluate how the use of science kits enhances practical skills, facilitates conceptual understanding, and encourages active engagement among learners. Another key objective is to compare the achievement scores of students exposed to science kit-based practical with those who follow conventional laboratory methods, in order to determine whether science kits offer a more effective approach to experiential learning. The study also seeks to explore whether gender plays a role in the effectiveness of practical activities and learning outcomes, thereby understanding any differential impact on boys and girls. Additionally, the research aims to gather perceptions from teachers, headmasters, and students regarding the practicality, usability, and educational value of the science kit training program. By achieving these objectives, the study intends to identify strengths and limitations in the implementation of science kits in classroom settings, provide actionable insights for teacher training, and contribute to improving the overall quality of science education. Ultimately, the goal is to enhance students' scientific knowledge, experimental skills, and positive attitudes toward learning science.

12. **Methodology:**

The study employs a mixed-method research design, combining both quantitative and qualitative approaches to comprehensively assess the effectiveness of the training program on science kits at the secondary school level. The research has been conducted in selected schools across Madhya Pradesh and Chhattisgarh, targeting students of classes IX and X, along with their science teachers and school administrators.

A pre-test and post-test design was be used to measure students' achievement in science before and after exposure to science kit-based practicals. The experimental group was engaged with science kit activities, while a control group was followed conventional laboratory methods. Quantitative data was collected using structured achievement tests, and analyzed using statistical software (SPSS) through descriptive and inferential techniques such as mean scores, standard deviation, t-tests, and ANOVA to determine the significance of differences in student learning outcomes.

Qualitative data was collected through interviews and observation schedules with teachers, headmasters, and students to explore their perceptions, experiences, and challenges associated with the training program. Classroom observations were

employed to document students' engagement, practical skills development, and teacher facilitation during science kit activities. Triangulation of qualitative and quantitative findings were used to provide a holistic understanding of the program's effectiveness and its impact on student achievement, gender differences, and overall teaching-learning processes in science.

13. **Findings:**

The findings of the study indicate that the implementation of the science kit-based training program had a positive impact on students' learning outcomes at the secondary level. Students who engaged in practical activities using the science kits demonstrated higher achievement scores in science compared to those following conventional laboratory methods. The hands-on approach enabled learners to better understand abstract scientific principles and relate them to real-life experiences, thereby enhancing conceptual clarity and retention.

Classroom observations revealed that the use of science kits encouraged active student participation, collaborative learning, and inquiry-based exploration. Students were more confident in performing experiments and interpreting results, which fostered a scientific temperament and critical thinking skills. Teachers reported that the training program enhanced their pedagogical practices, helping them act as facilitators rather than mere transmitters of content. They were able to guide students through structured experimentation and promote experiential learning effectively.

However, some challenges were observed, including initial hesitation among students unfamiliar with hands-on activities and the need for continuous teacher support to manage resources and ensure proper execution of experiments. Gender analysis showed no significant difference in achievement, indicating that both boys and girls benefitted equally from the intervention. Overall, the science kit training program proved to be an effective strategy for improving practical science learning and teaching practices.

14. **Implications:**

The study has several important implications for science education at the secondary level. First, it demonstrates that hands-on, kit-based practical learning significantly enhances students' understanding of scientific concepts, making abstract principles more tangible and relatable to real-life situations. This suggests that integrating structured practical activities into the curriculum can improve learning outcomes, increase engagement, and foster critical thinking and problem-solving skills among students.

Second, the findings emphasize the role of teacher training in effective science instruction. By equipping teachers with the skills to use science kits and guide

experiential learning, educational institutions can transform classrooms into active learning environments where students take initiative in constructing knowledge. This aligns with NCF-2005 recommendations, positioning teachers as facilitators rather than mere transmitters of content.

Third, the study highlights the importance of equitable learning opportunities. As both boys and girls benefited equally, practical-based interventions can be a means to reduce gender disparities in science achievement and promote inclusive education.

Finally, the findings encourage policymakers and school administrators to invest in well-designed science kits, continuous teacher support, and hands-on learning infrastructure. This approach not only strengthens students' cognitive skills but also nurtures scientific curiosity, creativity, and lifelong interest in science, contributing to overall educational quality and holistic development.

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16. Keywords: Science kit, practical learning, achievement, teachers

8. Research Abstract

1. **Theme/Subject:**	Science Education/ Environmental Education
2. Stage of Education:	Pre-service student-teachers
3. Topic of Research:	Effectiveness of Language lab activities in developing the pronunciation skills
4. Name and Address of the Investigators(s) with email:	Dr. Shruti Tripathi, DESSH
5. Name of the Institution where the Research was conducted	RIE Bhopal
6. Category: (Research study/Action research/Other)	Research Study
7. Language of Research Report:	English
8. Year of Completion:	2017-18
9. Published/Unpublished:	Unpublished

10. Introduction:

Pronunciation is one of the most critical and challenging aspects of learning English for non-native speakers. Accurate pronunciation forms the foundation for effective communication, ensuring that messages are clearly conveyed and correctly understood by listeners. Mispronunciation can result in communication gaps, misunderstandings, and reduced confidence, particularly for prospective teachers who are required to use English as the medium of instruction in many schools. Prospective teachers in regional institutes often come from diverse linguistic and educational backgrounds, which can contribute to variations and difficulties in pronunciation. The ability to pronounce words correctly, along with proper stress, intonation, and rhythm, is essential for effective classroom communication, teaching other subjects, and interacting with students and colleagues. Language laboratories provide an ideal platform to improve pronunciation by offering structured practice, feedback, and exposure to standard English sounds. The present study seeks to explore the role of the language lab in enhancing the pronunciation skills of prospective teachers. By systematically training students through audio-visual exercises, drills, and guided practice, this research aims to equip prospective teachers with the phonetic knowledge and practical skills required to achieve intelligible, fluent, and confident spoken English for effective teaching.

11. **Objectives:** The primary aim of this study is to enhance the pronunciation skills of prospective teachers to improve their overall communicative competence in English. Specific objectives include:

(1) improving the accuracy and clarity of pronunciation among B.A/B.Ed students;

(2) providing a comprehensive understanding of the phonetic sounds of the English language, including vowels, consonants, diphthongs, and syllable patterns;

(3) enabling students to use proper stress, rhythm, and intonation while pronouncing words and sentences, facilitating natural and fluent speech;

(4) motivating prospective teachers to utilize language lab resources effectively for pronunciation practice;

(5) demonstrating the practical methods and exercises available in a language lab for acquiring correct pronunciation;

(6) sensitizing students to the significance of pronunciation skills in teaching English and other subjects; and

(7) encouraging consistent practice to build confidence in spoken English. The study also aims to identify the impact of structured language lab interventions on students' pronunciation improvement. By achieving these objectives, the study will provide both theoretical and practical insights into pronunciation teaching, enabling prospective teachers to communicate effectively, perform better in classrooms, and foster enhanced learning experiences for their future students.

12. Methodology:

The study adopted an experimental research design to evaluate the effectiveness of language lab interventions on pronunciation skills of prospective teachers. The sample consisted of 40 first-year B.A/B.Ed students enrolled in 2017, selected purposefully to represent diverse regional and educational backgrounds. A pre-test was administered to assess students' baseline pronunciation accuracy, including their articulation, stress, and intonation patterns. The experimental intervention involved systematic training in the language lab, where students practiced English phonetics through audio-visual exercises, repetition drills, recording and playback exercises, and interactive software tasks. The sessions emphasized individual and group practice, enabling learners to identify errors and receive immediate feedback. Following the intervention, a post-test was conducted using similar assessment criteria to measure improvement. Data analysis employed the paired t-test to compare pre-test and post-test scores, determining the statistical significance of changes in pronunciation skills. Additionally, observational notes and qualitative feedback from students were

collected to assess engagement, motivation, and the perceived usefulness of the language lab. The methodology ensures a rigorous evaluation of the intervention, highlighting both quantitative improvements in pronunciation and qualitative enhancements in learners' confidence, interest, and understanding of English phonetics.

13. **Findings:**

The study revealed that the use of a language lab significantly improved the pronunciation skills of prospective teachers. Comparative analysis of pre-test and post-test scores demonstrated measurable gains in articulation, stress, and intonation patterns, indicating enhanced phonetic accuracy. Students displayed improved ability to pronounce vowels, consonants, and diphthongs correctly, contributing to clearer and more intelligible speech. Observational feedback showed increased confidence in oral communication, with learners actively engaging in repetition drills, recording exercises, and interactive phonetic tasks. The language lab facilitated individualized learning, allowing students to correct errors independently while benefiting from immediate feedback. Moreover, group activities promoted collaborative learning, enabling students to learn from peers' pronunciation patterns and enhance social learning skills. While comprehension and overall oral fluency improved, some students required additional practice to master more complex intonation patterns. Qualitative feedback indicated high motivation to continue practicing outside formal sessions, emphasizing the lab's role in fostering autonomous learning. The findings confirm that structured language lab interventions can effectively address pronunciation difficulties among non-native speakers, equipping prospective teachers with essential communication skills. Consequently, the study highlights the importance of integrating language lab training into teacher education programs for developing confident, articulate, and professionally competent English language instructors.

14. **Implications:**

The study highlights the critical role of language labs in developing pronunciation skills among prospective teachers. It demonstrates that structured phonetic training enhances articulation, stress, intonation, and overall oral fluency, enabling teachers to communicate effectively in English. Teacher education programs can benefit by integrating language lab sessions into curricula, providing consistent and guided practice in pronunciation. The findings suggest that exposure to audio-visual models, interactive exercises, and recording-based feedback promotes autonomous learning, self-correction, and peer-assisted learning, fostering both cognitive and affective engagement. Improved pronunciation skills can enhance classroom teaching across subjects, as teachers gain confidence in

using English as a medium of instruction. Policymakers and institutional heads should ensure that language labs are adequately equipped with interactive software, audio-visual tools, and monitoring mechanisms to maximize learning outcomes. Additionally, workshops and training sessions on effective use of lab resources can guide prospective teachers in developing lifelong communication skills. The study also underscores the broader significance of pronunciation mastery in professional development, employability, and cross-cultural communication. Implementing structured pronunciation interventions can thus contribute to higher teaching quality, better student outcomes, and the overall effectiveness of English language education in teacher training institutes.

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16. Keywords: Pronunciation, Language Lab, Prospective Teachers, Communication, Phonetics, Fluency

9. Research Abstract

1. **Theme/Subject:**	Science Education/ Environmental Education
2. Stage of Education:	Secondary Stage
3. Topic of Research:	Study of Innovative Teaching and Learning Practices in Science at the Secondary Stage
4. Name and Address of the Investigators(s) with email:	Dr. Rashmi Sharma
5. Name of the Institution where the Research was conducted	RIE Bhopal
6. Category: (Research study/Action research/Other)	Research Study
7. Language of Research Report:	English
8. Year of Completion:	2016-17
9. Published/Unpublished:	Unpublished

10. **Introduction:**

The present study was conducted to explore and document innovative teaching-learning practices in science at the secondary school level in Bhopal city, Madhya Pradesh. Recognizing the critical role of effective pedagogy in enhancing student understanding and engagement, the study aimed to identify methods and strategies adopted by science teachers to make learning more meaningful and interactive. A survey was conducted across 50 schools, involving both science teachers and school principals. Data collection was guided on seven parameters, including the topic of innovation, target group, description of the innovation, sources of finance, outcomes, and the individuals involved in its implementation. The study identified thirteen significant innovative practices currently employed in teaching science. These practices revealed a wide range of approaches, such as the integration of ICT, use of smart classes, engagement play for conceptual understanding, wall magazines, activity-based worksheets, flow charts, concept maps, and field visits to science centers and gardens. Additionally, innovative practices included student participation in preparing teaching-learning materials, painting exhibitions on energy conservation, and virtual laboratories. The study further observed that while most science teachers engage in innovative practices, many are unaware that these efforts constitute innovation as per formal definitions. Overall, the study highlights the creativity and commitment of secondary school science teachers in enhancing pedagogical effectiveness and fostering active learning environments.

11. **Objectives:** The primary objective of this study is to explore and document innovative teaching-learning practices in science at the secondary school level in Bhopal city, Madhya Pradesh. Specifically, the study aims to identify the various strategies and pedagogical methods adopted by science teachers to enhance students' understanding and engagement in science concepts. It seeks to examine the range of innovations in teaching, including the use of ICT tools, smart classes, virtual laboratories, and multimedia resources, to make science learning interactive and meaningful. The study also intends to analyze the implementation of activity-based worksheets, role plays, wall magazines, concept maps, flow charts, and field visits to science centers and gardens as methods to foster experiential learning. Furthermore, it aims to assess the involvement of students in preparing teaching-learning materials and participating in exhibitions and projects, highlighting their active role in the learning process. Another objective is to evaluate the sources of support, financial or otherwise, that enable these innovations and to examine the outcomes and effectiveness of such support systems in improving conceptual clarity and learning motivation. Finally, the study intends to create awareness among teachers and stakeholders regarding the significance of innovative practices and to recommend strategies for promoting and sustaining these pedagogical innovations in secondary school science education.

12. **Methodology:**

The study adopted a descriptive survey research design to collect comprehensive data on innovative teaching-learning practices in science at the secondary level in Bhopal city. A total of 50 schools, both government and private, were selected as the sample for the study using purposive sampling to ensure representation across different school types. The respondents included science teachers and school principals, who provided detailed information regarding the innovations implemented in their classrooms. Data collection was carried out using structured interviews, observation schedules, and questionnaires developed specifically for the study, focusing on seven key parameters: topic of innovation, target group, brief description, sources of finance, outcomes, persons involved, and sustainability. Field visits and classroom observations were conducted to directly witness the implementation of innovative practices such as ICT integration, role plays, virtual laboratories, activity-based worksheets, concept maps, wall magazines, and field trips. The data were systematically recorded, categorized, and analyzed to identify recurring patterns, types of innovations, and their effectiveness in enhancing student learning. Descriptive statistical techniques such as frequency counts and percentages were employed to summarize the data, while

qualitative insights from interviews and observations were analyzed through thematic analysis. The methodology ensured a holistic understanding of science teaching innovations in the selected schools.

13. Findings:

The study revealed that innovative teaching-learning practices in science are widely implemented across secondary schools in Bhopal, though awareness of these practices as formal "innovations" was limited among teachers. Out of the 50 schools surveyed, 13 distinct types of innovative practices were identified. The most commonly used methods included ICT integration through smart classes and virtual laboratories, activity-based worksheets, role plays, and concept maps for conceptual understanding. Teachers also employed creative pedagogical tools such as wall magazines, painting exhibitions, and environmental objects for teaching biology. Field visits to science centers, gardens, and relevant industrial sites were utilized to provide experiential learning opportunities. Many teachers encouraged student participation in preparing teaching-learning materials, enhancing engagement and deeper comprehension of scientific concepts. Observations indicated that schools incorporating ICT and activity-based learning reported higher student involvement, better understanding of complex concepts, and improved retention of knowledge. Constraints such as limited resources, lack of training, and insufficient time were noted, but teachers demonstrated adaptability by using low-cost materials and creative techniques. Overall, the findings suggest that while innovations are diverse and effective, systematic support, awareness, and professional development could further enhance their impact on student learning outcomes and scientific curiosity.

14. **Implications:**

The findings of this study carry significant implications for improving science education at the secondary level. Firstly, the widespread use of innovative teaching practices indicates that teachers are willing and capable of adopting creative methods, highlighting the importance of professional development programs that formally introduce and train teachers in innovative pedagogical strategies. Integration of ICT, virtual laboratories, and activity-based learning demonstrates that technology can enhance conceptual understanding, suggesting that policymakers should invest in infrastructure, digital resources, and continuous technical support. Encouraging student participation in preparing teaching-learning materials can foster critical thinking, creativity, and a sense of ownership, which emphasizes the need for student-centered learning approaches in curricula. The study also underscores the value of experiential learning through field visits and real-world applications, implying that schools should prioritize

such activities for holistic development. Additionally, awareness programs for teachers and administrators about the concept of innovation can bridge the gap between informal practices and formal recognition, leading to better documentation and scaling of effective strategies. Overall, systematic support, targeted training, and resource allocation can amplify the impact of innovative practices, enhance learning outcomes, stimulate scientific curiosity, and create a more engaging and effective science education environment in secondary schools.

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16. Keywords: Science Education, Innovative Practices, Secondary Schools, ICT Integration, Experiential Learning, Student Engagement

10. Research Abstract

1. **Theme/Subject:**	Science Education/ Environmental Education
2. Stage of Education:	NA
3. Topic of Research:	Assessment of Tree Species of Mysore City to Combat Air Pollution: An Evaluation Study
4. Name and Address of the Investigators(s) with email:	Dr. Vinod Singh Gour vinodgour@riemysore.ac.in
5. Name of the Institution where the Research was conducted	Regional Institute of Education, Mysore
6. Category: (Research study/Action research/Other)	Research Study
7. Language of Research Report:	English
8. Year of Completion:	2024-25
9. Published/Unpublished:	Published

10. Introduction:

Air pollution poses a significant threat to urban environmental quality and human health worldwide. Trees have been recognized as vital natural allies in mitigating air pollution through their ability to capture particulate matter (PM) and absorb gaseous pollutants. Different tree species vary significantly in their potential to accumulate pollutants due to differences in leaf morphology, physiology, and tolerance to environmental stress. This study aimed to assess the efficiency of 25 commonly occurring tree species along roadsides in Mysore city in accumulating particulate matter of various sizes (PM11, PM>2.5, and PM<2.5). The research also examined how leaf size influences PM capture and calculated the Air Pollution Tolerance Index (APTI) for these species to evaluate their suitability for urban forestry and pollution mitigation efforts. Employing gravimetric methods and rigorous statistical analysis, the study not only identified the most efficient species for particulate matter accumulation but also developed an educational module for secondary school students to foster scientific aptitude and environmental awareness related to air pollution. By integrating scientific evaluation with practical education, this research offers actionable insights for urban planners and educators to enhance urban green cover and equip young learners with critical thinking skills to address environmental challenges effectively.

11. Objectives:

- To identify the most efficient tree species for accumulation of particulate matter (PM) in Mysore

- To compare tree species in Mysore city for their efficiency in accumulating particulate matter
- To determine the effect of leaf size on PM accumulation, studying the variation in the amount of different-sized particulate matter accumulated on leaves
- To develop a module for secondary school students to inculcate scientific aptitude, practical skills, evidence-based knowledge, data analysis, and critical thinking related to solving the problem of PM in the air.

12. Methodology:

Leaf samples were collected from twenty-five tree species located along roadsides in Mysore city, ensuring no rainfall occurred 15 days prior to sample collection to avoid wash-off effects. The gravimetric method was used to estimate accumulated PM on leaf surfaces; PM was separated by size using various filter papers with different cut-offs. PM mass per unit leaf area was calculated for each tree species and each PM type, using graph paper to measure leaf area. Cluster analysis identified Peltophorum pterocarpum as the most efficient species to scavenge PM. Leaf samples of three leaf sizes (small 71.33 cm^2, medium 100 cm^2, large 160 cm^2—accounting for adaxial and abaxial surfaces) were collected from this species, and PM amounts were separated and quantified across three samples per leaf size and particle size, yielding 27 observations. The Air Pollution Tolerance Index (APTI) was calculated for species based on chlorophyll content, leaf pH, ascorbic acid, and relative water content using standard scientific methods. Data were subjected to normality tests followed by ANOVA, Duncan's Multiple Range Test, and cluster analysis.

13. Findings:

The study examined 25 tree species in Mysore city for their potential to accumulate particulate matter (PM) and their tolerance to air pollution, measured via the Air Pollution Tolerance Index (APTI). The species Peltophorum pterocarpum emerged as the most efficient scavenger of PM among the trees evaluated. Other species like Cascabela thevetia, Ceiba pentandra, Callistemon lanceolatus, Terminalia arjuna, and Swietenia mahagoni also showed significant potential for PM accumulation and tolerance. Leaf size influenced the ability to capture PM; small and medium-sized leaves accumulated greater amounts of particulate matter compared to larger leaves, suggesting the importance of leaf morphology in pollution mitigation. The study's APTI results categorized species as tolerant or moderately tolerant, supporting their selection for urban afforestation efforts in

Mysore. Species such as Swietenia mahagoni, Diospyros virginiana, Acacia auriculiformis, Grevillea robusta, Delonix regia, and Terminalia arjuna were identified as suitable for improving air quality. These findings provide a scientific basis for prioritizing tree species in urban environments with high pollution levels, underscoring the ecological role of urban forestry in enhancing air quality and public health.

14. Implications:

This research carries multiple implications for urban environmental management and education. Identifying tree species with high particulate matter accumulation and pollution tolerance informs urban forestry planning, enabling targeted planting to mitigate air pollution in Mysore and similar urban settings. The preference for species with small to medium-sized leaves can guide species selection for roadside and park plantations to maximize PM removal. The development of a scientifically grounded educational module for secondary school students is a significant contribution, fostering environmental awareness and critical thinking about air pollution and natural mitigation strategies. By embedding scientific inquiry and data analysis skills into education through place-based learning, students are empowered to engage with local environmental issues actively. This module aligns with educational goals promoting scientific temperament, practical skills, and evidence-based knowledge acquisition. Ultimately, combining urban ecological insights with environmental education creates synergies that can lead to better-informed citizens and healthier urban ecosystems, making this study valuable for urban planners, educators, and policymakers addressing air quality challenges.

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16. **Keywords:** Particulate Matter, Urban Forestry, Air Pollution, Tree Species, Leaf Size, Air Pollution Tolerance Index (APTI), Mysore, Environmental Education

11.Research Abstract

1. **Theme/Subject:**	Science Education/ Environmental Education
2. Stage of Education:	NA
3. Topic of Research:	A Cross-Cultural Study of Medicinal Plants among the Tribal Groups of Mysore District
4. Name and Address of the Investigators(s) with email:	Dr. Kanwaljeet Singh kanwaljeet@riemysore.ac.in
5. Name of the Institution where the Research was conducted	Regional Institute of Education, Mysore
6. Category: (Research study/Action research/Other)	Research Study
7. Language of Research Report:	English
8. Year of Completion:	2024-25
9. Published/Unpublished:	Published

10. Introduction:

Ethnobotany is the interdisciplinary study of the dynamic relationship between people and plants, focusing on the traditional knowledge and cultural practices surrounding the use of plant resources. This field explores how indigenous and local communities utilize plants for medicinal, nutritional, spiritual, and economic purposes, preserving ancient wisdom passed down through generations. With rising interest in biodiversity conservation and sustainable development, ethnobotanical studies provide crucial insights into native plant species and their roles within ecosystems and cultures. The knowledge held by tribal populations about medicinal plants is invaluable not only for healthcare and cultural preservation but also for informing modern science and environmental stewardship. This research seeks to document and compare the ethnomedicinal plant knowledge across different tribal groups in the Mysore district, illuminating the diversity and commonalities in plant use. By bridging traditional knowledge systems with contemporary education frameworks, the study aims to foster awareness of cultural heritage, promote ecological conservation, and support the integration of indigenous knowledge into modern curricula as envisioned by national education policies. Such research contributes to sustaining both local biodiversity and cultural identity while enhancing educational relevance in students' lives.

11. Objectives:

- To study indigenous plant knowledge and herbal practices among the tribal groups of Mysore district.
- To undertake a comparative study of indigenous plant knowledge among different tribal groups in Mysore district.
- To bridge the gap between traditional ethnomedicinal knowledge and current plant application.

12. Methodology:

The research employed a survey methodology to record traditional knowledge of medicinal plants among the tribal population of Mysore district. Data were collected using a standardized, semi-structured questionnaire along with field surveys involving farmers, herbal practitioners, homemakers, and community facilitators. A pilot test ensured research authenticity. Fifty individuals were interviewed in October-November 2024, with verification provided by a Junior Project Fellow. Reliability was assessed by Cronbach's Alpha ($\alpha = 0.91$), demonstrating high dependability. Field visits and interviews from October to December lasted 3 to 19 days to build rapport as tribal participants were initially hesitant to share knowledge. Informants were selected by snowball and random sampling procedures, totalling 104 participants from five tribal communities (Jenu Kuruba, Betta Kuruba, Yerava, Soligaru, Hakki Pikki). Data reliability was ensured by multiple visits and replication phases. The data were cleaned, verified, and organized systematically. Botanical names were standardized by consulting experts, and quantitative analysis employed cultural ethnobotanical indices such as Cultural Importance Index (CI), Informant Consensus Factor (ICF), and Jaccard Index (JI).

13. Findings:

The study documented 101 medicinal plant species of 88 genera and 45 families treating 59 ailments across 20 disease categories. Fabaceae was the most used family. Common species included Zingiber officinale Roscoe, Aloe vera, Euphorbia tirucalli, Rauvolfia serpentina, Centella asiatica, Tinospora cordifolia, Piper nigrum, Calotropis gigantea, Citrus limon, and Ocimum tenuiflorum. Disease categories such as Genital, Fertility-related, and Blood disorders had the highest Informant Consensus Factor of 1, reflecting unanimous agreement on plant usage. Cross-cultural analysis showed 14% overlap in plant use across six tribal groups. Leaves were the most utilized plant part (41%), followed by fruit (15%), bark (14%), roots (9%), seeds (6%), stems and flowers (5% each), bulbs (2%), and rhizomes, corms, tubers (1% each). Preparation methods for herbal remedies

involved pastes, cooked forms, raw, decoctions, juices, powders, poultices, and infusions, predominantly administered orally (61.7%) or topically (37.5%). The Jaccard Index ranged from 6% to 17.9%, highlighting ethnobotanical knowledge differences due to ecological, ethnic, and cultural diversity. Thirteen plant species were common to all tribes, with varying degrees of similarity and dissimilarity across others. Thirty-four species were reported with new medicinal uses. The study highlights important cultural, ecological, and educational implications, emphasizing alignment with NEP 2020 and NCF 2023 policies for incorporating indigenous knowledge in curricula to foster environmental conservation and holistic learning experiences.

14. Implications:

This ethnobotanical study offers valuable insights to integrate indigenous knowledge systems into school education curricula for fostering biodiversity awareness, culturally responsive pedagogy, and scientific inquiry. It supports NEP 2020's emphasis on linking local knowledge with global responsibilities and NCF 2023's vision for place-based learning and ecological literacy. Documenting medicinal plants with cultural importance encourages sustainability and health awareness and aligns with curricular interdisciplinary approaches. Recommendations include using quantitative ethnobotanical indicators (e.g., ICF, CI) as STEM teaching tools, establishing herbal gardens, involving communities in ethnomedicinal practices, and creating ethnobotanical modules for enhanced holistic development and environmental stewardship. This integrative approach enhances student engagement with local biodiversity and indigenous wisdom while promoting critical thinking and sustainability education consistent with national educational frameworks.

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16. **Keywords:** Medicinal Plants, Ethnobotany, Tribal Knowledge, Mysore, Indigenous Practices, Biodiversity