



A STUDY OF STATUS OF SCIENCE LABORATORIES IN SECONDARY SCHOOLS OF SURAT CITY

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Abstract

The present world is a world of science and technology. Everything and every event happening around us demand some knowledge of simple scientific facts or principles. “Learning by doing” and “learning by living” are the two cardinal principles of teaching and same is true in case of teaching science. It is the natural urge in the children to make things; to break things and to handle things but the present curriculum does not provide ample opportunities for the students for self expression, independent research, constructive activities and projects. For an effective science teaching, the facilities for experimentation should be provided by using the science laboratory.

The role of science laboratories schools goes far beyond the confines of traditional classrooms. These laboratories offer dynamic spaces where curiosity and students’ interest are sparked, hypotheses are tested, and a profound understanding of scientific principles is cultivated

The study dealt with the status of science laboratories in secondary schools of Surat city was conducted. The findings of the study revealed that in most of the secondary school’s science laboratories were there, having enough required physical facilities. In most of the schools’ experiments were demonstrated on content related to science textbook but students revealed that they find difficulties in conducting experiments independently. The most of the teachers had revealed that the science experiments had created curiosity for many science concepts, which were not clear to them and it has also changed the attitude towards science. The students and teachers had revealed that science laboratories were very useful in achieving the objectives of science teaching, development of educational and social values and providing experiential learning.

INTRODUCTION:

The present age is marked by rapid progress and development in science. The improvement of the society is directly linked with the quality of science education and science educators. Science helps to enhance the thinking process, understand how things around us actually operate, develop the students’ logical reasoning due to the cause and effect relationship, it develops a positive attitude, open mindedness and suspended judgment, increase one’s awareness of environment and understanding the problems of global warming, satisfy the curiosity and creativity of a child. Taking in to consideration the importance of science and its potential to change the society, almost all the commissions and committees in our country have made efforts to make ‘Science’ a compulsory subject in our schools. On this line the important recommendations of different commissions and committees are mentioned here under:

The report of the Secondary Education Commission (1953), recommended the teaching of General Science as a compulsory subject in the high and Higher Secondary Schools. The all India seminar on the teaching of Science in Secondary School held at Tara Devi Report (Simla Hills) in 1956, dealt with almost all the problem facing for the Higher Secondary Classes. According to its report, it was suggested a unique and uniform system of Science Teaching for the entire country, suited to its needs and resources.

The Education Commission (1964-66), has pointed out that our science education is in bad shape and it becomes worse if we fail to reckon with the explosion of knowledge. The commission recommended that “we lay great emphasis on making science an important element in the school curriculum. We, therefore, recommended that Science and Mathematics should be taught on a compulsory basis of all pupils as a part of general education during first ten years of schooling. In addition, there should be provision of special courses in these subjects at the Secondary stage for students of more than average



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ability.” The teaching of science during first 10 years of school education has been strongly recommended in the National Policy of Education (NPE) (1986). It is recommended that science education should develop well-defined abilities and values such as the spirit of inquiry, creativity, objectivity, the courage to question and aesthetic sensibility. The fact methods and practices of science should be used as tools for attaining these abilities and values. Science education program should enable the learner to acquire problem solving and decision-making skills and to discover the relationship of science with health, agriculture, industry and other aspects of daily life. Every effort should be made to extend science education to the vast numbers who have remained outside the pale of formal education.

It is essential to foster a deep and enduring passion for science among students in the ever-evolving landscape of education. The role of science laboratories in modern schools is essential if we want to equip the next generation with the skills and knowledge necessary to tackle ever-increasing global challenges. Establishing well-equipped science laboratories in schools is an important aspect of achieving this goal. In these laboratories, students absorb theoretical knowledge and actively engage in hands-on experiments on modern laboratory equipment, which propels them into the realm of scientific exploration.

IMPORTANCE OF SCIENCE LABORATORY:

In modern schools, science laboratories play a crucial role in providing students with hands-on experiences and practical applications of scientific concepts. The role of science laboratories in schools includes cognitive, practical, and affective aspects that help students learn and grow. Here are some key roles:

1. Experiential Learning

Laboratories provide students with the opportunity to engage in experiential learning, enabling them to observe, experiment, and discover scientific principles on a firsthand basis. This hands-on approach helps students understand and remember concepts better than learning only in theory.

2. Theoretical Knowledge Application

The students will be able to apply theoretical knowledge gained in science classrooms to real-world scenarios in laboratories. Laboratories provide students with the opportunity to witness and experience the practical application of the theoretical concepts taught in the classroom. This helps students understand scientific concepts and see their relevance in practical situations.

3. Critical Thinking and Problem-Solving

Science laboratories teach students how to think critically and solve problems by guiding them through experiments, looking at data, and making conclusions. These skills are essential for success in scientific fields and are transferable to various aspects of life.

4. Practical Skills Development

Laboratory work encourages the development of various skills, such as observation, measurement, data analysis, and interpretation. Students learn how to use scientific equipment, do experiments, make observations, and record data. These abilities are highly valuable in both academic and professional settings.

5. Encouragement of Curiosity and Interest

Lab environments stimulate students' curiosity and interest in science by providing a dynamic and interactive environment. Engaging in experiments can spark a passion for scientific inquiry and discovery. Students are encouraged to ask questions, design their own experiments, and explore the world of science beyond the confines of textbooks.



6. Preparation for Higher Education and Careers

Practical experience in modern laboratories prepares students and equips them with the skills required for more advanced science courses and other advanced studies and careers in STEM-related fields that include science, technology, engineering, and mathematics.

7. Safety Awareness

Understanding and following safety guidelines are essential skills that learners can carry into various scientific and workplace contexts, and not only in laboratory settings. The controlled environment of laboratories allows students to learn about and practice safety protocols.

8. Teamwork and Collaboration

Interpersonal skills are valuable in both academic and professional settings. Many laboratory activities involve group work, which is an ideal way to foster teamwork, communication, and collaboration among students.

9. Technology Integration

By incorporating cutting-edge technologies in learning experiences, modern science laboratories allow students to interact with advanced equipment and tools. This exposure helps them stay abreast of technological advancements in the various scientific fields.

10. Assessment of Understanding

The activities of learners in laboratories allow science and chemistry teachers to assess students' understanding of scientific concepts in a practical context. This form of assessment complements traditional testing methods.

Effective laboratory learning includes effective synthesis. A strong foundation in research skills is often linked to effective synthesis. This includes the ability to find relevant information, assess its credibility, and incorporate it into your synthesis.

In short, with clever lab planning, science labs in modern schools help students learn better by making learning fun and engaging. This helps them understand science better and prepares them for future studies and careers.

RATIONALE OF THE STUDY:

The present world is a world of science and technology. Everything and every event happening around us demand some knowledge of simple scientific facts or principles. The gifts of science have been profitably used for making life comfortable and raising the standard of living. But the use or abuse of the wonderful gifts of science depends on man and his mind. One should be open-minded, rational enough to see the positive or negative aspect of science. A person having high scientific attitude can do this task effectively. Therefore, Citizen with scientific attitude is must in a country like India. Since we have people with different religion, caste, language, customs, traditions, it is expected that every citizen should have respect and tolerance for others customs, traditions, religion etc. and therefore Scientific attitude which is very crucial for the development of nation, is necessary to develop in our children.

In the absence of comprehensive philosophy of science education, the question that most needs an answer is "what is the justification for teaching science and technology in our schools?". Is it to have an educated citizenship or to provide adequately prepared and motivated students to fulfil the industrial needs of the country?. Is scientific literacy one of the goals of science education?. If it is who can be considered scientifically literate?. According to one definition, a scientifically literate individual is one who makes informed decisions within a science and technology context by drawing upon their rich scientific knowledge, such as, an understanding of the concepts, principles, theories and processes of science (Abd-El-



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Khalick et al, 1998). Many science educators view achievement of scientific literacy as the educational solution to the varied economic, social and environmental challenges of the 21st century.

It is becoming clear that the teaching science has no single unambiguous aim. Different groups in society view the aims of science education differently. Some see the aims in vocational terms (providing skilled workforce); others perceive educational goals, in developing the individual potential of the child. The production of highly qualified scientists and engineers is a valued objective, while another is to produce educated citizens. There is no shortage of statements of aims, but the translation of these aims to measurable objects result in the loss of important aspects and reduces science education to trivialities (Woolnough, 1989).

“Learning by doing” and “learning by living” are the two cardinal principles of teaching and same is true in case of teaching science. It is the natural urge in the children to make things, to break things and to handle things but the present curriculum does not provide ample opportunities for the students for self expression, independent research, constructive activities and projects. For an effective science teaching, the facilities for experimentation should be provided by using the science laboratory. This is possible only if adequate apparatus of right type is available in the science laboratory. Laboratory work forms the basis of scientific study. In order to arrive at any conclusion experimentation is needed. The achievements of science and technology today are all due to the experimental method.

Report of National Curriculum Framework (2005) emphasized constructivist approach and given due importance to revitalize the methodologies of learning. Constructivism includes cooperative learning, collaborative learning, active learning, experiential learning, problem based learning and hands on learning as its methodologies. This can be done by providing wide range of activities and experiences to the learners. Science by its nature has immense scope of using various activities in the science classroom, laboratory and outside. Activity based science teaching involves multiple senses of learner, which helps to insure their involvement in the learning and leading them for self learning also. National Council of Educational Research and Training (NCERT, 1986) in the guideline of curriculum transaction described that “Among the techniques of instruction, which play an important role in the type of effective curriculum transaction involving activity based approach, the teacher has to be apt at; planning activities, preparing the students for activities, conducting and supervising activities and conducting discussion for evaluating learning out comes. Teachers require due exposure to the ways and means of conducting various activities in science. This remains a prerequisite for providing various activities to students by the science teachers. We need teachers who organize learner centered, activity based, participatory learning experiences, play projects, discussion, dialogue, observation, excursions and learn to reflect on their own practice”.

Science is the study of facts and the way we interact with the world. Learning about the scientific method teaches children how to ask questions and gather the evidence needed for the most complete answer. Comprehensive science education lets students learn how to develop ideas, discover the world around them, and ask challenging questions about our place in that world.

Science education at the secondary level should help students understand scientific concepts and develop practical skills through observation, experimentation, measurement, and evidence-based reasoning. Laboratory work can support both learning scientific ideas and learning how to carry out scientific investigations. A systematic review of secondary-school science research identifies these as key purposes of laboratory work and emphasizes the role of teacher guidance in supporting inquiry (Gericke et al., 2023). India’s National Education Policy 2020 also calls for hands-on, experiential, and inquiry-based learning across school subjects (Ministry of Education, 2020). These aims depend, in part, on whether schools have accessible, functional laboratories and whether teachers and students can use them regularly.

Recent national data make it timely to examine the condition of these facilities. The UDISE+ 2024–25 report records an integrated science laboratory in 166,209 of India’s 290,950 schools with secondary sections—57.1% overall. The share varies by school management: 51.7% for government schools, 63.9% for government-aided schools, and 61.8% for private unaided schools (Ministry of Education, 2025). These figures describe reported availability, but they do not by themselves establish whether laboratories are adequately equipped, functional, safe, or regularly used for practical lessons.



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A local investigation is therefore needed to assess more than the presence of a laboratory. Examining its equipment and materials, maintenance, safety provisions, accessibility, scheduling, and actual use can give a fuller picture of the learning opportunities available to students. It can also identify practical barriers faced by science teachers and school leaders. The findings may help school administrators and education authorities target improvements in laboratory provision and use, and support the experiential and inquiry-based approach envisaged in national policy. Accordingly, the proposed study will investigate the status of science laboratories in secondary schools, focusing on their availability, adequacy, and utilization.

In school laboratories, students are active learners, not just passive recipients of knowledge. Science provide students with various opportunities to learn and experiment, which plays a crucial role in the ongoing intellectual development of students at any academic level. Science labs give students the time, space, and resources to explore and experiment. As students progress through different educational levels, the use of science labs should evolve as well. The early exposure to age-appropriate, hands-on activities lays the foundation for further, more complex experimentation and research, and visualization of real-world differences they can make. The goal is to cultivate a curiosity for science, develop critical thinking skills, and prepare students for future academic and professional pursuits in safe environments. Hence the study was conducted on to study the status of science laboratories.

STATEMENT OF THE PROBLEM:

A study of status of science laboratories in secondary schools of Surat city

OBJECTIVES OF THE STUDY

- 1) To study status of science laboratories of secondary schools of Surat city in terms of
 - a) Physical facilities available
 - b) Organization of practical work
 - c) Methods used for practical work
 - d) Evaluation of practical work
 - e) learning experiences
- 2) To study the problems faced during practical work by
 - a) Students
 - b) Teachers
- 3) To give suggestions for improving the quality of practical work

RESEARCH METHOD

In present study the research method used was survey method.

POPULATION

All the students, teachers and Principals of 61 Grant-in -aid secondary schools of Surat city of academic year 21-22, comprised the population for the present study.

SAMPLE:

For the present study, random sampling technique was used. Using random.org app 20 secondary schools of academic year 2021-22 were selected out of 61. From 20 schools, all the principals, all the science teachers and randomly 15 students of 9th and 10th standard were selected. So, 20 principals, 25 teachers and 300 students comprise the sample for the present study.



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TOOL AND TECHNIQUE:

Observation schedule was prepared for the observation of science laboratories and Interview schedule was prepared for school principals. The questionnaire was also prepared for students as well as teachers, containing both open ended and close ended questions on various aspects of science laboratory such as physical facilities available, organization of practical work, methods used for practical work, evaluation of practical work, learning experiences provided and problems faced by students and teachers.

COLLECTION OF DATA:

For the purpose of collecting data for the study, investigator had personally visited the 20 secondary schools of Surat city administered all the tools such as observation schedule, interview schedule, questionnaire on the sample and collected the data.

PROCEDURE OF DATA ANALYSIS

Factual information collected was analyzed quantitatively by using frequency and percentage analysis. Information obtained in open ended questions and interview schedule was qualitatively analyzed by content analysis technique.

MAJOR FINDINGS:

- ❑ In most of the school's science laboratory was available, having enough physical facilities for conducting science experiments. The students were given necessary equipment's and tools from school for conducting science experiments. In most of the schools, teachers taught most of the experiments, which is there in science textbook. The most of the teachers had reported that deadstock register is maintained in the science laboratories.
- ❑ The most of the principals of the schools had said the financial requirements of the science laboratories were fulfilled using the grants provided by the Government and fund raised by the school management board. The government provides the grants to schools based on the result of the schools, which is not enough for finance required for science laboratories.
- ❑ With regard to the science laboratories, the most of the students reported that experiments were taught using science laboratories and teachers provide proper guidance for conducting experiments but still students find difficult to carryout science experiments independently. The experiments given to students were appropriate as per their age level. All the experiments related with the content of science textbook were done in the science laboratories.
- ❑ With regard to organization of practical work, most of the teachers said that organization of practical was done before starting of the experiment with the help of students but they also said the time given was not enough for organization of practical work. The practical work was conducted using demonstration method.
- ❑ The most of the teachers had reported that the evaluation of practical work was not done by giving experiments to the students. In the final examination, evaluation of practical work was not done in science laboratories and marks of practical work is not carry forwarded in annual examination.
- ❑ With regard to the experience of teachers for teaching science experiments in laboratory, the most of the teachers had said that students participate very actively with interest in conducting experiment. The experiments increase knowledge and understanding of students in science subject, but due high student teacher ratio, it was difficult for teachers to pay proper attention on individual students. The most of the students had reported that, they feel difficulty in conducting experiments on topics related to chemistry, physics, plant cell and animal cell.
- ❑ With regard to the problems faced in laboratories, the most of the teachers had reported that there is lack of enough tools for conducting experiments in science laboratories. Sometimes due electricity shutdown experiments remain incomplete. The time allocated for practical work was not enough and If some students remain absent in practical work, they are not getting another chance for doing the experiments. The teachers had said that they do not have enough time for practical work so sparing extra time for guiding poor students was not possible.



- ❑ The most of the teachers suggested that there is a need of modification in curriculum related to science experiments. The science laboratory should be bigger in size with having enough required physical facilities. The generator should be there so when no electricity is there, experiments can be conducted uninterrupted. The exhaust fan should be there in science laboratory. The more time should be allocated for conducting science experiments. In each science laboratory arrangement should be made in such a way that students can conduct experiments individually.
- ❑ During covid- 19, teachers had sent link of Diksha portal to students for science experiments. Teachers had also used online Microsoft application and you-tube videos for teaching science experiments to students. The most of the teachers had reported that it was very difficult to explain science experiments in online mode of teaching. During online teaching of science experiments students were not paying attention properly and it was difficult to explain content deeply.
- ❑ To increase the quality of science laborites, the most of the principals suggested that in 9th and 10th standard practical work should be made compulsory. There is need of establishment of advanced science laboratories in all the schools and more experiments should be taught to secondary school students so they can understand the importance of practical work. The science laboratories should be bigger in size and enough amount of grant should be provided for establishment and running of science laboratories.
- ❑ The most of the teachers had revealed that the science experiments had created curiosity for many science concepts, which were not clear to them and it has also changed the attitude towards science. The students and teachers had revealed that science laboratories were very useful in achieving the objectives of science teaching, development of educational and social values and providing experiential learning.

CONCLUSION:

The role of science laboratories schools goes far beyond the confines of traditional classrooms. These laboratories offer dynamic spaces where curiosity and students' interest are sparked, hypotheses are tested, and a profound understanding of scientific principles is cultivated.

As we stand at the threshold of a future brimming with technological advancements and complex global challenges, the investment in science laboratories is an investment in the intellectual capital of our youth. Schools that foster an environment that encourages scientific literacy, hands-on exploration, and critical thinking prepare students for academic success and empower them to become active contributors to scientific advancements that will shape our world.

The findings of the present study revealed that in most of the secondary school's science laboratories were there, having enough required physical facilities. In most of the schools' experiments were demonstrated on content related to science textbook but students revealed that they find difficulties in conducting experiments independently. The most of the teachers had revealed that the science experiments had created curiosity for many science concepts, which were not clear to them and it has also changed the attitude towards science. The students and teachers had revealed that science laboratories were very useful in achieving the objectives of science teaching, development of educational and social values and providing experiential learning.

Hence, we should encourage science laboratories in schools, recognizing them as crucibles of inspiration and innovation that will propel society forward into the future, guided by the inquisitive minds they help to inspire. The school science laboratory experiences can play an integral part in student attitudes toward science and ultimately contribute to students' achievements later in life.

References:

1. Abu, A. O. (2024). Effect of practical laboratory activities on senior secondary school students' performance on process skills acquisition in biology. *Journal of Health and Human Movement Studies*, 1(1), 9–15.
<https://www.johmos.org.ng/index.php/johmos/article/view/3>



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2. Arshad, H. M., Saleem, K., & Sajid, M. (2024). Utility of science laboratories: An analysis of secondary school students' perceptions. *Harf-o-Sukhan*, 8(1), 600–674. <https://harf-o-sukhan.com/index.php/Harf-o-sukhan/article/view/1200>
3. Gericke, N., Högström, P., & Wallin, J. (2023). A systematic review of research on laboratory work in secondary school. *Studies in Science Education*, 59(2), 245–285. <https://doi.org/10.1080/03057267.2022.2090125>
4. Kumari, P., Balimuttajjo, S., & Aheisibwe, I. (2025). Science laboratory availability and functionality in secondary schools of Mbarara City, Uganda: A qualitative investigation. *East African Journal of Education Studies*, 8(2), 738–749. <https://ir.must.ac.ug/handle/123456789/4105>
5. Minhas, M. A. (2025). Evaluating laboratory conditions for science education: A comparative study of public and private secondary schools in Dera Ismail Khan. *CARC Research in Social Sciences*, 4(4), 11–14. <https://doi.org/10.58329/criss.v4i4.195>
6. Rafique, S., Dayan, U., & Asma, A. (2024). Experiences of teachers and students in science laboratories with reference to problems and facilities: A study of secondary schools (Peshawar). *Journal of Asian Development Studies*, 13(2). <https://doi.org/10.62345/jads.2024.13.2.21>
7. Shahzadi, I., Hassan, K. H. U., & Zahid, F. (2023). Role of laboratories and science teaching material in science teaching and students learning at secondary level in public schools. *Journal of Development and Social Sciences*, 4(2), 259–264. [https://doi.org/10.47205/jdss.2023\(4-II\)23](https://doi.org/10.47205/jdss.2023(4-II)23)