**12.1 SCIENCE LABORATORIES**

**History**

Science laboratories were introduced in 1800s in America and Europe. Even though laboratories have been part of school education for two centuries, yet a clear and authentic articulation of their role in students’ learning of science remains elusive.

A fact finding committee in America, gathered information on a wide variety of approaches to laboratory education, arrived at the term “laboratory experiences” to describe teaching and learning that may take place in a laboratory room or in other settings.

**Definition of laboratories**

* A laboratory is a facility that provides controlled conditions in which scientific or technological research, experiments and measurements may be performed.
* “Science laboratory experiences provide opportunities for students to interact directly with the material world (or with data drawn from the material world), using the tools, data collection techniques, models and theories of science”.
* “Laboratory experiences” describe teaching and learning that may take place in a laboratory-room or in other settings.
* Rapid developments in science technology and cognitive research have made the traditional definition of science laboratories as under,

***“A room in which students use special equipments to carry out well defined procedures”***

**Previous Definition of Laboratories**

* A form of practical work taking place in a purposely assigned environment where students engage in planned learning experiences and interact with materials to observe and understand phenomena (some forms of practical work such as field trips are thus excluded)

**Goals**

* The secondary goal of preparing the future scientific and technical work-force.
* Secondary and senior secondary school science education aims to provide scientific literacy for all as part of a liberal education and to prepare students for further science study, work and citizenship.

**Objectives**

Objectives that may be achieved through the use of the laboratory in science classes

* **Skills:** e.g.manipulative, inquiry, investigative, organizational, communicative.
* **Concept:** e.g. hypothesis, theoretical, model, taxonomic category.
* **Cognitive abilities:** e.g. critical thinking, problem solving, application, analysis, synthesis.
* **Attitude:** e.g. curiosity, interest, risk taking, objectivity, precision, confidence, perseverance, satisfaction, responsibility, consensus, collaboration and living science.
* **Understanding the nature of science:** e.g. scientific enterprise, scientists and how they work, existence of a multiplicity of scientific methods, interrelationship between science and technology, and among the various discipline of science.

**Advantages of science laboratories**

Science laboratory is a work place for the conduct of scientific research and experiments. It is imperative to have the latest and high quality science labs these days.

* Effective teaching and learning of science involves seeing, handling and manipulating real objects and materials.
* Students get a first-hand learning experience by performing various experiments on their own.
* Students are made to use the models and understand different scientific theories and concepts.
* It helps students to remember the concept better.
* It helps to transfer the experience to other learning situations.
* It is a facility that provides controlled conditions in which scientific research, experiments and measurement may be performed.
* Besides offering the hand-on experience, science lab equipments teach students how to make a scientific argument.
* Conducting experiments, reviewing them closely, developing logical reasoning and responding to analytical comments, are the valuable skills that help in preparing the next generation of scientists, engineers and medical professional.
* Science labs develop abilities to use inductive and deductive reasoning to arrive at a valid conclusion which,
* Distinguish among facts and opinions.
* Identify false premises in an argument.
* Use mathematics to solve problems.
* Achieving the goal of scientific literacy for all our students, as well as motivating some students to study further in science, may require diverse approaches for the increasingly diverse body of science students.
* Contribution of laboratories lies in helping students develop skills in manipulating equipment and acquire a feel for phenomena.
* The laboratory experiences help students understand materials, phenomena, concepts, models and relationships.
* Laboratory activities are co-ordinated with text-books in order to deepen students’ understanding of the books.
* The curriculum integrates the laboratory activities into class routines. The activities are more effective than the traditional curriculum in boosting the students’ science achievement and interest in science.
* Students are required to improve the quality of science education in order to improve employment opportunities, including opportunities in science. Laboratory activities help to achieve the objective.
* Role of the laboratory is to elevate the important new approaches to science education in order to help students understand the nature of modern scientific research.
* Laboratory is a way of thinking about scientific investigations--an intellectual process rather than building with specialized equipment.
* An approach deserves the introduction that “laboratories should go further than simply engaging students”. Senior secondary students must actively participate in scientific investigations and—use the cognitive and manipulative skills associated with the formulation of scientific explanations.
* In response to the growing awareness most of the schools/institutions have made efforts to improve laboratory education for students. Scientific study and literacy for all students is the primary goal of secondary school science education.
* Cognitive psychologists and science educators have found that the teacher’s expectations, interventions and actions can help student’s development, understanding of scientific concepts and ideas.

**Importance of lab work**

* Science is essentially a practical activity which proceeds through the testing of theories by means of experimental work and observations.
* The experiments carried out in the laboratories are an integral part of the teaching and learning process of the course.
* The students are encouraged to prepare in advance of each laboratory session by reading the experiment sheet, searching the literature for information on the theoretical background of the experiment and planning the layout report.

**Main aims of the laboratory work**

* To make the students familiar with some of the equipment and terminology used in science.
* To help students understand the underlying principles, theories behind the experimental techniques and test the theoretical knowledge with real data.
* This will enable students to appreciate the applicability and limitations of the theory.
* To train the students in the analysis of data in its presentation in tables and graphs.
* To help students develop the skills for writing and presenting technical reports in the most effective manner.
* To give students experience of working in a team.
* Team work will be of Importance to the students whatever they finally pursue.
* To train students in carrying out procedures.
* To train students in experimental methods.
* Laboratory training is also frequently used to develop skills necessary for more advanced study or research.

**Laboratory experience includes the following students’ activities.**

* Physics experiments
* Chemistry experiments,
* Biology experiments,
* Experiments in earth science etc.
* We too need the excellent quality of science labs for literacy of our students of secondary and senior secondary classes—both to meet the economy’s need for skilled workers and future scientists, doctors and engineers.
* To develop scientific habits that can help citizens in their everyday life,
* A goal is required to establish that **“all students should achieve scientific literacy”**. All students should try to develop,
* Abilities necessary to do scientific inquiry.
* Understandings about scientific inquiry.
* Internet facility nowadays can give remote access to scientific instruments and observations. Students sitting in a classroom can experience laboratory activities enabled by internet links to remote instruments. It necessitates the establishment of a smart-board in addition to the required equipments and chemicals in the laboratory.

**Importance of science lab equipments**

* Students get a first hand learning experience by performing various experiments on their own.
* School’s science lab equipments make teaching and learning easy both for the teachers and students.
* By virtue of equipping themselves with the latest and advanced materials, schools are able to contribute a lot in the scientific advances yet to come.
* Children develop interest in scientific research in science laboratories.
* Laboratory plays a vital role in bringing up the next generation of engineers, doctors and scientists.

***Therefore schools are required to have the latest science lab, supplies and equipments to make science interesting and effective for students and to encourage them to make significant contributions in the fields of physics, chemistry, biology and other streams of science later in their life.***