

# Integrated Science Lab: An Innovation in Government Schools of Jharkhand

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**Abstract:** We know that the knowledge gained through careful observation and theoretical reasoning is known as science. It opposes beliefs and thoughts, raises questions, doubts, and observes reality. It is analysed practically, that is, practised by doing and establishing universal theory, calculation, and results which are the same in every corner of the world. Here, we meet in a place where experiments are conducted. That spectacular place is known as the laboratory, that is, the warehouse of theories. In one word, we can say that the laboratory is the birthplace of theories and re-evaluation centre of scientific beliefs, calculations, results, and knowledge.

Labs are a basic need of science education because they enhance the scientific temperament and provide realistic breakthroughs for students in observing phenomena. We cannot imagine science studies without lab facilities. Laboratory practical's enhance the concept of science learning. But we observe that so many government schools do not have proper infrastructure for individual laboratory facilities in individual subjects like physical science, chemical science, biology, etc. Now, in this modern era, instead of individual labs, integrated labs have been growing rapidly.

A laboratory is a learning environment where the students engage in groups or learn individually and phenomena. It gives them chances to put into practice several theoretical concept through observation, exercise, and practical experiments using materials[1].

The integrated science lab is an innovative idea in Jharkhand's government schools. Its great feature is that it combines lab activities from all science subjects, like physical science, chemistry, biology, and also mathematics. It is a composite lab that is highly portable and suitable for use in small spaces. My present paper focuses on this.

**Keywords:** Integrated Lab, Scientific Temperament, Laboratory Practical's, Universal Theory, Realistic Breakthroughs.

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## I. INTRODUCTION

According to De La Cruz (2022), science education's primary goal is to cultivate scientifically literate individuals who can make responsible decisions and apply scientific knowledge to address community problems. This field is designed around three domains of learning science: understanding and using scientific knowledge, performing scientific processes and skills and developing and demonstrating scientific attitudes and values. Hence, science education includes science laboratory instruction to help students achieve scientific literacy [2].

The laboratory is essential to connect field conditions (concrete operations) with laboratory conditions (formal operations) as a bridge to facilitate the adaptation process of students' thinking in learning (Slavin 2019; Suseno 2012)[3].

The terms laboratory (lab) and practicum are often used in education, especially in the exact sciences, but precise definitions are rarely found. In general, a lab or practicum is defined as a general activity about students interacting with a material to observe natural phenomena (Hofstein and Mamlok-Naaman, 2007). For years, educators have believed that science cannot mean anything without practical activities, especially in school laboratories [4].

Science education is the field concerned with sharing science content and process with individuals not traditionally considered part of the scientific community. Education plays an indispensable role in a rapidly evolving economic development. Similarly, science is relevant for building the economic and national development of the country. For the country to compete in the globalization of the industrial

market, it needs human resources who are scientifically literate and skilled [5].

Science practical work can be used to help students achieve a number of learning outcomes, including: getting a feel for natural phenomenon, developing investigation skills and processes, providing a platform of experiences on which conceptual understanding can be built, giving students a sense of nature of science, and the excitement of inquiry and discovery. Practical work provides opportunities for students to develop learning outcomes that contribute to scientific literacy including the skills and understanding needed to conduct scientific investigations and to critically evaluate the claims made by others based on scientific evidence ( Venville and Dawson, 2004)[6]. Science education emphasizes the concept of science as an active learning activity in which critical and scientific skills are developed through observation, hypothesis formulation, experimentation, data analysis, and development of inquisitive, critical, honest, and open attitudes (Chusnani, 2013). Thus, science education becomes a source of learning for students to apply scientific knowledge in everyday life with a positive attitude and favourable personality [7].

These above lines are perfectly fit for integrated science lab. In this lab, the standard subject consent syllabus is used. Specifically, as seen in East Singhbhum , the state lab design intends to enhance the self-learning process. In every apparatus arrangement, instructions are displayed, including totals and QR scanner codes. Any student can use these QR codes to access all related information and videos. Here smartphones play an important role in scanning and displaying the videos. It increases the student's learning by doing, which creates curiosity about how it's possible in a particular experiment.

Learning in the science laboratory environment has been recognized over a decade for its role in fostering positive students' attitudes about science and for the development of students' interest in science subjects. Positive students' attitude allows students to have the ability to manipulate properly the different science or laboratory equipment (Luketic & Dolan, 2013). Moreover, several researches demonstrated the significant influence of the laboratory environment on student learning[8]. Integrated science lab create this environment in schools. There are 51 labs are running in east singhbhum smoothly.(source district education office).

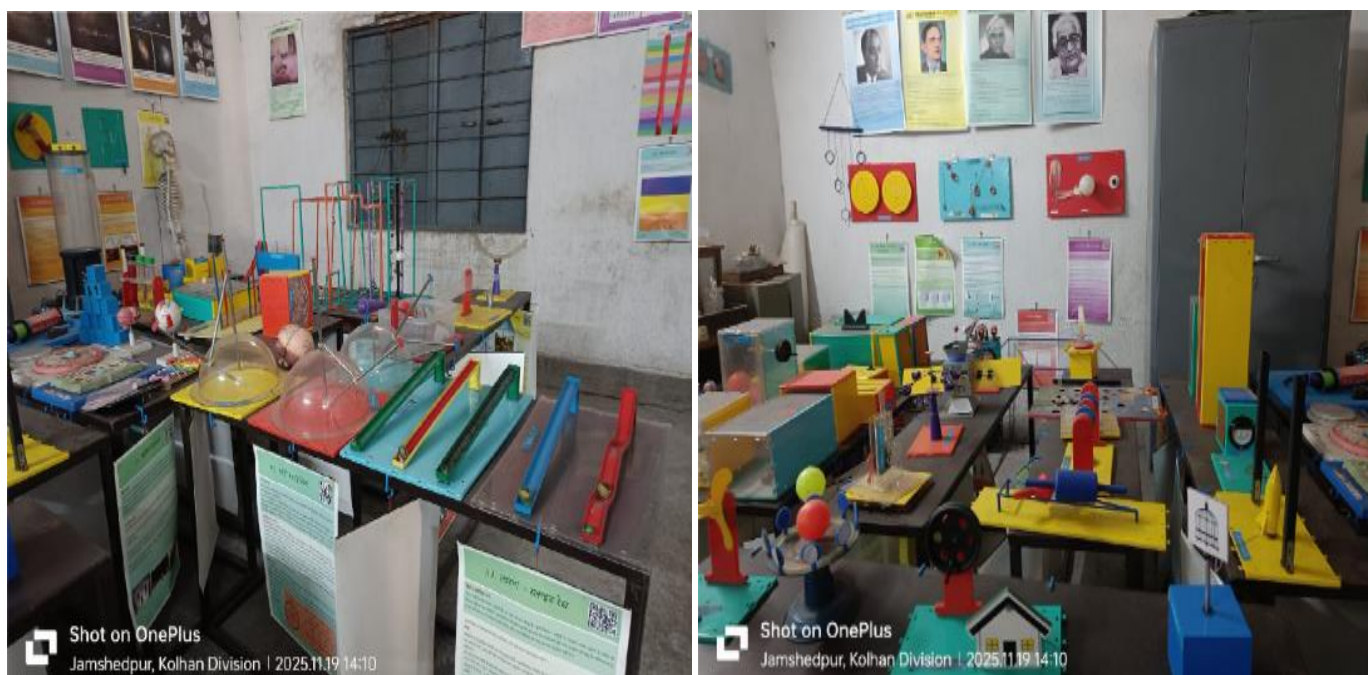


Fig 1 & 2-A Well Designed Integrated Science Lab in a Govt. School.



Fig-3 A Deostration Work Shown in Int.Lab

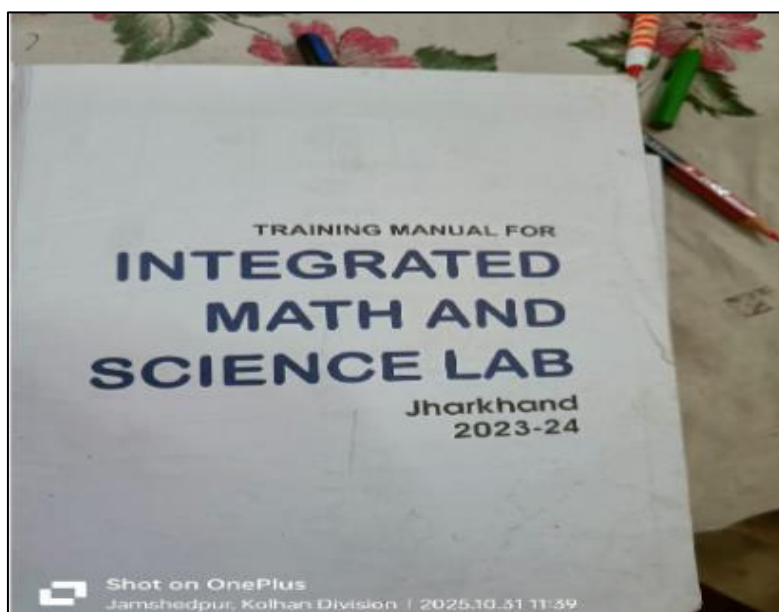


Fig 4-A Training Manual for Integrated Science Lab

## II. SILENT FEATURES OF INTEGRATED SCIENCE LAB

### ➤ Critical Thinking

Its provide the critical thinking among the students These labs allow students to explore scientific concepts through experiments, demonstrations, and observation, fostering a deeper understanding of scientific principles[9]. Through conducting experiments, analysing data, and drawing conclusions in science lab students develop their critical thinking and problem-solving skills[10].

### ➤ Hands on Learning

Integrated science labs offer a range of experiments and activities suitable for different topics and grade levels. These experiments may include investigations into chemical reactions, circuit building, biological specimen observation, dissections, plant growth studies, environmental monitoring, and more [11].

### ➤ Teacher Guidance

Trained science teachers are crucial in guiding students through experiments and activities in the integrated science labs. They provide instructions and explanations and facilitate discussions to enhance students' understanding. Teachers also assist in data interpretation and encourage students to think critically about the outcomes of their experiments [12].

### ➤ Skill Development

Integrated science labs aim to develop essential scientific skills among students. These include observation, measurement, data collection and analysis, hypothesis formation, experimental design, teamwork, and communication skills. Practical exposure in the labs prepares students for future scientific pursuits and higher education in science-related fields[13].

#### ➤ *Curiosity*

Lab environments ignite curiosity and interest by offering dynamic, hands-on experiences. Experiments inspire scientific inquiry, encouraging students to ask questions, design experiments, and explore the world of science beyond textbooks [14].

#### ➤ *Construction of the Knowledge*

Laboratory work develops crucial scientific skills such as observation, measurement, data analysis, and proper scientific equipment USE [15]. For instance, using laboratory-based demonstration methods supports learners participation and construction of their own knowledge in all academic activities .

#### ➤ *Learning Assessment*

Laboratory activities help science teachers assess students' understanding of scientific concepts in a practical context, complementing traditional tests and providing a well-rounded evaluation of learning[16].According to Asamoah, (2024), laboratory work is the core of science education. While performing laboratory work, the students get an opportunity to develop their own abilities to design, conduct, interpret and report scientific investigations [17].

#### ➤ *Inquiry-Based Learning*

The modern learning environment focuses on fostering critical thinking and problem-solving skills. There is a shift towards inquiry-based learning, encouraging students to formulate questions, design experiments, and draw conclusions. Method of motivation-Implementation of practical working teaching and learning has been taken as a method that motivates and brings learners' interest in their learning [18].

#### ➤ *Student-Centric Approach*

Modern laboratories are designed to be more student-centric and collaborative. The learners are actively engaged in hands-on activities, working in groups to explore and discover scientific concepts. Students most concerned about the impact of the laboratory activities and their preferences pointed more toward greater independent, participatory, and interactive learning engagements [19].

#### ➤ *Comprehensive Approaches*

The fact that students may engage in experiments that bridge multiple scientific disciplines reflects the interconnected nature of scientific knowledge. Students' experiences in science laboratories are mediated, human–technology–world, through experimental technologies, there is an obvious need to consider how the world can be experienced [20].

#### ➤ *Learning Environment*

laboratory environment allows students to gain a first-hand experience with course concepts and further provides them with the opportunity to explore methods used by scientists in their discipline [21].

#### ➤ *Effect on Students' Attitude*

The science laboratory has a direct effect on both students' attitudes and academic performance as per the instructional theory of learning interaction. It is generally believed that constant practice leads to proficiency in what the learner learns during classroom instruction; hence, the dictum “practice makes perfect” (Hager, 1974)[22].

### III. CONCLUSION

science laboratories in schools are vital to developing the scientific literacy of the country. As defined by de Borja & Marasigan (2018), laboratory is the heart of science in which individuals could put theory into practice. The science teachers need training/seminars in handling laboratory facilities and in facilitating science laboratory activities. In international education, many schools already have laboratories as places to carry out practical activities. Thus, in science education such as biology, chemistry, and physics, there are always experimental activities, where students try, hold, do, observe, analyse, discuss, and present results. The mechanism is a way to prove theories and to create innovation in the field of science (Sukmadinata, 2005)[23] . When students are not able to engage meaningfully with lab equipment, it can lead to a lack of motivation, decreased hands-on experience, and ultimately poor learning outcomes .On the basis of above discussion we come to the conclusion that the integrated science lab will change the learning scenario of the Jharkhand state and we can pathways towards sustainable global growth in the 21<sup>st</sup> century.

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