# Experiential Learning in Science in Odisha Government Schools: Perceptions and Practices

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## Abstract

*Experiential learning is an educational approach that facilitates the understanding and application of scientific concepts by integrating theoretical knowledge with practical, hands-on experiences. This study explores the resources, perceptions, practices and challenges involved in planning and implementing experiential learning in secondary science education in government schools in the Mayurbhanj district of Odisha. Using a mixed-method approach, data were collected through surveys from both quantitative and qualitative perspectives. The findings indicate a positive inclination towards experiential learning among all respondents. The facilitators perceived that experiential learning improves engagement, understanding, retention and the practical application of science beyond academics. Learners found it motivating and effective in making abstract concepts concrete through hands-on experiences. While there is a strong emphasis on incorporating effective practices, such as hands-on activities and real-world applications, notable gaps exist in collaboration, reflective opportunities and addressing diverse needs of learners. However, over-experiential learning lance on rote learning, limited interdisciplinary approaches, insufficient resources, time constraints and large class sizes hinder effective implementation. The study concludes that increased infrastructure funding, specialised training and careful planning are essential to fully realise the potential of experiential learning, thereby enhancing science education and better preparing students for the future.*


***Keywords:*** *Experiential learning, perception, hands-on experiences, science education*

## Introduction

Experiential learning, rooted in the philosophies of John Dewey and David Kolb, is a dynamic educational approach wherein individuals learn through direct experience and subsequent reflection (Beard and Wilson, 2013). Unlike traditional passive learning, experiential learning actively engages learners in real-life contexts, fostering critical thinking, problem-solving and decision-making skills. Dewey (1938) emphasised that true learning occurs through active engagement and reflection, which shape future actions. Kolb (1984) expanded on this by introducing a four-stage model of experiential learning: (a) concrete experience, (b) reflective observation, (c) abstract conceptualisation and (d) active experimentation. This cyclical process enables learners to experience, reflect, conceptualise and apply their knowledge in various contexts.

Experiential learning can take many forms, including field trips, simulations, project-based learning, internships and cooperative activities (Gilbert, et al. 1982). These methods enable students to apply theoretical knowledge in real-life contexts, enhancing understanding and developing essential skills. Cannon and Simpson (1985) note that hands-on science education allows students to experiment, observe, analyse data and draw conclusions, deepening their grasp of scientific concepts. Experiential learning fosters active engagement and intrinsic motivation by making learning relevant and meaningful (Sharma, 2006). Burch, et al. (2016) highlight that active learning, a key component of experiential learning, integrates experience and reflection, encouraging students to engage with the world beyond the classroom.

In science education, experiential learning is highly effective, enabling students to explore phenomena through direct interaction and experimentation, fostering curiosity and understanding (Jaber, 2002). Activities like experiments, museum visits and science fairs make science classes tangible and exciting. Experiential learning integrates hands-on activities, critical thinking and real-world applications, preparing students for both academic success and real-world challenges. This approach aligns with the needs of modern education, particularly science, where active engagement with the material is essential for understanding complex concepts.

## Review of Related Literature

Researchers consistently highlight the benefits of experiential learning in enhancing educational outcomes across various subjects and levels. Bates (2014) outlines several experiential learning models—problem-based, case-based, project-based and inquiry-based learning—that positively impact various aspects of science education. Research studies suggest that these approaches enhance problem-solving skills (Funa and Prudente, 2021), improve teaching quality (Zhang and Campbell, 2012), increase enthusiasm for science (Rukhsana et al., 2022) and boost higher-order thinking skills as found by Ives and Obenchain (2006) in their study on high school students involved in experiential learning. Shrivastava (2002) noted that students with a scientific attitude and those using convergent learning styles performed better in science. Similarly, Williams (1990) and Fox (2012) confirmed that the Kolb model of experiential learning significantly affected knowledge acquisition, skill mastery and attitudes towards learning. García-Sánchez et al. (2023) found that innovative experiential learning methods, like mobile lab kits, improved scientific temperament, academic performance and inclusivity among underprivileged students. Assem et al. (2023) critiqued traditional science education for focusing on factual knowledge over process, advocating for an inquiry-based approach to stimulate active investigation. Research also supports the positive impact of experiential learning on prosocial behaviour (Burch, et al. 2016), empathy and well-being in adolescents (Reshmad'sa and Vijayakumari, 2017). Overall, these studies affirm that experiential learning is a robust pedagogical approach that enhances academic performance, critical thinking (James & Williams, 2017) and essential life skills (Voukelatou, 2019), making it a valuable tool in modern science education.

## Rationale of the Study

It is necessary to improve the level of science education in secondary schools. The National Education Policy 2020 (NEP 2020) emphasises comprehensive, interdisciplinary education and the need for practical, activity-based learning. Experiential learning has been shown to improve student interest, engagement and understanding of scientific concepts. Both NEP 2020 and the National Policy on Education 1986 (NPE 1986) highlight the importance of 'experiential, exploratory and activity-based learning" at the primary and secondary levels. Initiatives, such as Sarva Shiksha Abhiyan (SSA) and Rashtriya Madhyamik Shiksha Abhiyan (RMSA) and Samagra Shikshya, also stress the need for such approaches to improve the quality of education. Effective implementation of these policies requires an understanding of the barriers and enablers to experiential science learning at the secondary level.

This study will explore high school teachers' and students' perceptions and ongoing practices related to experiential learning in science, providing valuable insights to support the implementation of NEP 2020 and other government initiatives.

## Objectives

1. To examine the availability of infrastructure, resources and curricular activities conducted in implementing experiential learning in science at the secondary stage
2. To study the perceptions of teachers and students at the secondary stage in experiential learning in science
3. To investigate the practices and challenges at the secondary stage in planning and implementing experiential learning in science at the secondary stage

## Methodology

### Procedure

This research aimed to study the perceptions of experiential learning in science at the secondary stage in government schools of Mayurbhanj district of Odisha. To achieve the objectives of study, a mixed-method approach was adopted.

### Sample

A purposive sampling technique was employed to select the sample, which consisted of 30 science teachers and 100 students from 15 government schools in three selected blocks (Jashipur, Raruan and Baripada) of Odisha's Mayurbhanj district.

### Tools Employed

A review of related literature revealed that no standardised tool was available to study the perceptions and practices of secondary teachers and students regarding experiential learning in science. To develop the necessary tools, insights from related literature and expert opinions (four professors and one assistant professor) were considered. The tools included an information-cum-inventory schedule to assess infrastructure, resources and curricular activities for implementing experiential learning; two questionnaires for teachers and students to collect data on their perceptions, practices and challenges in planning and implementing experiential learning in secondary science education; and an observation schedule for classroom observations of related practices. The questionnaires were designed with 3-point Likert Scale and open-ended questions.

### Data Collection and Analysis

The study adopted both quantitative and qualitative approaches for data collection. The tools included open-ended questions and observations, along with close-ended statements. A descriptive analysis was used for analysing quantitative data. Necessary statistical tools, such as percentages and graphs, were applied to examine quantitative data, while logical and thematic analysis was used to assess qualitative data. The extensive participant-generated data was systematically organised by categorising under numerous headings. The information collected through the aforementioned tools was classified either independently or by grouping responses based on their intended purposes, as necessary.

## Major Findings of the Study

The first objective is to study the status of the availability of infrastructure, resources and curricular activities involved in implementing experiential learning in science at the secondary level. This analysis is based on data obtained from inventory-cum-checklist. The analysis of 'infrastructure' component consists of several aspects, such as adequate classrooms, playgrounds, science parks, libraries, computers, projectors, smart boards, printing devices, audio-visual tools, digital classrooms, resource rooms, science labs, art rooms and music rooms. Similarly, the analysis of 'resources for curricular activities' includes several elements, including science clubs, models for practical learning, display boards, access to digital platforms, science kits, basic lab supplies and reference materials. The analysis has been conducted on the basis of four levels—'Unavailable', 'Available', 'Functional' 'Accessible' to students (Figure 1).

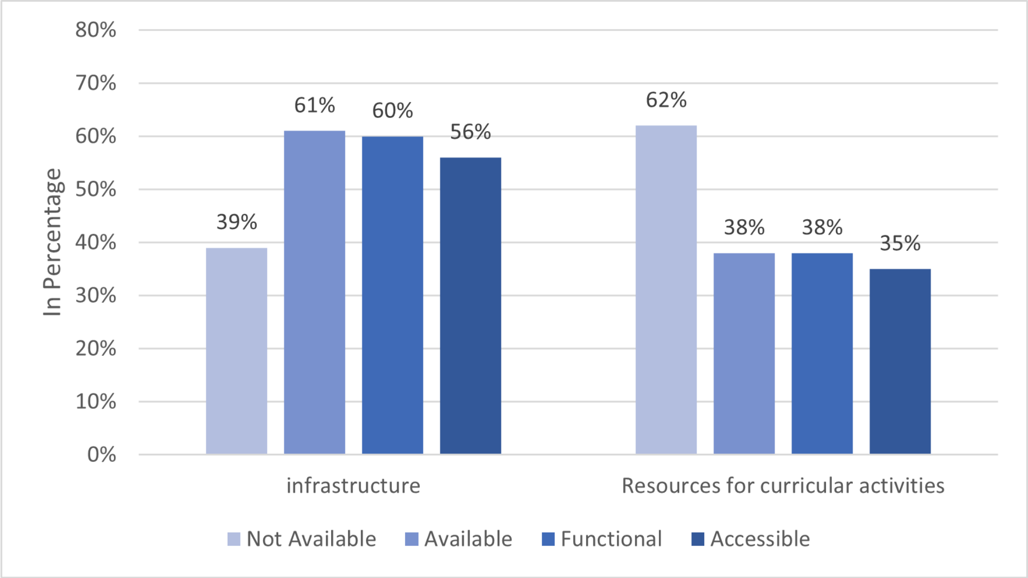


*Figure 1: The status of the availability of infrastructure and resources in implementing experiential learning in science at the secondary stage*

Figure 1 indicates that the availability and functionality of the necessary infrastructure are at a reasonable level, around 60%. However, only 56% of the infrastructure is accessible to students. In contrast, resources for curricular activities are limited, with less than 40% available and only 35% accessible to students. This highlights a significant gap in the provision of basic resources for curricular activities, which are crucial for the holistic development of students, specifically in science.

**Table 1: The status of schools conducting curricular activities for implementing experiential learning in science**

| S. No. | Activities | Conducted | Not conducted |
|---|---|---|---|
| 1. | Academic excursions | 100% | 0% |
| 2. | Science exhibitions | 0% | 100% |
| 3. | Co-curricular programmes | 0% | 100% |

The analysis of curricular activities under the first objective considered academic excursions, science exhibitions and co-curricular activities (see Table 1). None of the surveyed government schools had conducted academic excursions in recent years. However, all schools (100%) had organised co-curricular programs and science exhibitions, providing opportunities for the practical application of classroom learning and stimulate scientific interest. While basic educational facilities in government schools are relatively well-provided, resources for curricular activities and experiential learning are severely lacking. With only 35% accessibility, resources for curricular activities show a 21% shortfall compared to basic infrastructure.

## Teachers' Perceptions of Experiential Learning in Science

The second objective explores teachers' perceptions of experiential learning in science at the secondary stage. The analysis is based on a 3-point Likert Scale employed in the survey, consisting of three response levels—'Disagree', 'Undecided' and 'Agree'. The results are interpreted on the basis of these three themes, which are derived from the literature review.

**Table 2: Teachers' perceptions of experiential learning in science**

| S. No. | Statement | Disagree | Neutral | Agree |
|---|---|---|---|---|
| **A.** | **Effectiveness of Experiential Learning** | | | |
| 1. | It is an effective teaching method in science. | 0% | 0% | 100% |
| 2. | It can develop among learners scientific skills, such as problem solving, critical thinking, etc. | 6.7% | 0% | 93.3% |
| 3. | It encourages learning through innovative methods. | 0% | 0% | 100% |
| **B.** | **Methods and Tools supporting Experiential Learning** | | | |
| 4. | Atal Tinkering Lab (ATL) can foster scientific skills among learners. | 0% | 20% | 80% |
| 5. | Hands-on learning is a supplementary method of teaching science used along with traditional methods. | 26.7% | 43.3% | 30% |
| 6. | Sports is not a method of teaching science at the secondary stage | 40% | 50% | 10% |
| **C.** | **Goals and Necessity of Experiential Learning** | | | |
| 7. | The goal of experiential learning is to score well in exams. | 63.3% | 13.3% | 23.3% |
| 8. | Learning from experiences is for the less educated. | 80% | 16.7% | 3.3% |
| 9. | Activities are not necessary in science. | 96.7% | 3.3% | 0% |

Table 2 indicates a strong positive perception of teachers regarding the effectiveness of experiential learning in science education. All respondents (100%) agreed that experiential learning is an effective and inspiring method of teaching. Additionally, the majority (93.3%) believed that it helped develop crucial scientific skills like problem-solving and critical thinking.

However, there are mixed perceptions regarding the tools and methods that support experiential learning. A significant proportion of teachers (20%) remained neutral about the effectiveness of the Atal Tinkering Lab (ATL), while only 10% agreed with its role in experiential learning. A majority (50%) of the teachers are neutral with the opinion that sports is not a method of teaching science, suggesting uncertainty or lack of understanding about its effectiveness as a tool and method.

Furthermore, less than 40% of the teachers either agreed or disagreed with the view that hands-on learning complements traditional methods, while over 40% responded neutrally, indicating scepticism about its role in science education.

A large number of teachers (63.3%) disagreed with the notion that achieving good marks is the primary objective of experiential learning. Simultaneously, an overwhelming majority (96.7%) disagreed with the statement that activities are not necessary in science, reinforcing their understanding of the essential role of activities in science education. Additionally, 80% of the teachers disagreed with the idea that experiential learning is only necessary for less-educated students, asserting their belief in its universal applicability.

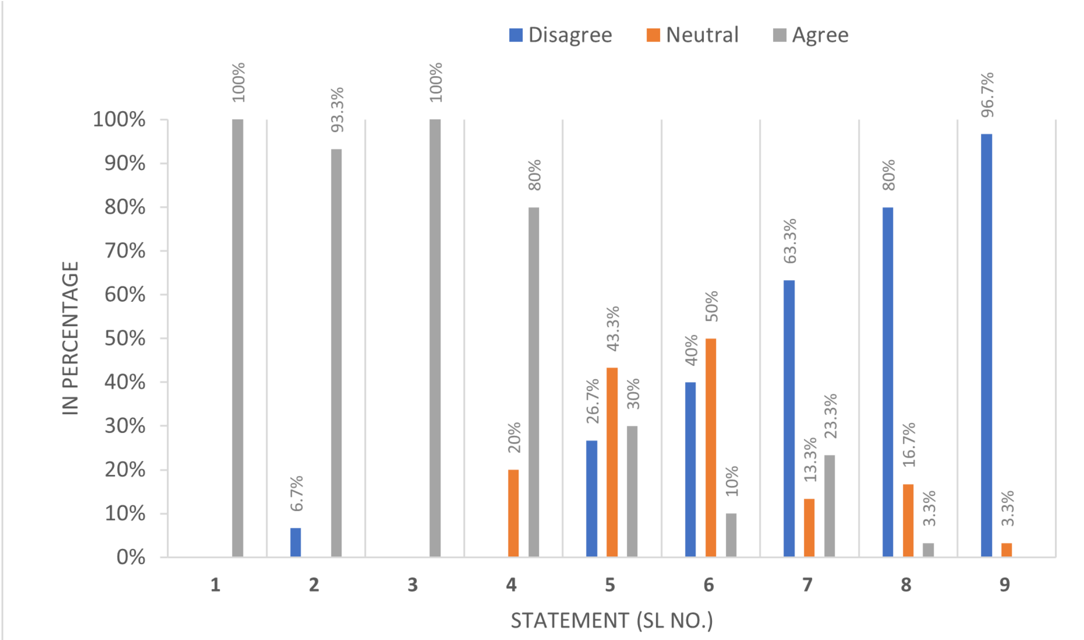


*Figure 2: Teachers' perceptions in experiential learning in science at the secondary stage*

## Students' Perceptions in Experiential Learning in Science

The second objective examines students' perceptions of experiential learning in science at the secondary stage. The analysis follows the quantitative analysis of data obtained from a 3-point Likert Scale employed in the survey under few distinct themes (see Table 3).

**Table 3: Students' perceptions of experiential learning in science**

| S. No. | Statement | Disagree | Neutral | Agree |
|---|---|---|---|---|
| **A.** | **Impact of experiential learning** | | | |
| 1. | My experiences help me understand science. | 0% | 0% | 100% |
| 2. | Hands-on experiences help in understanding the application of science in real world. | 2% | 5% | 93% |
| 3. | Doing activities or conducting science experiments in class improves critical thinking skills. | 75% | 8% | 17% |
| 4. | Project work is stressful. | 2% | 1% | 97% |
| 5. | My skills get improved when I learn by doing. | 2% | 4% | 94% |
| 6. | Experiments or activities in science class are related to daily life. | 4% | 8% | 88% |
| 7. | Activities or experiments helps in other fields of study. | 5% | 2% | 93% |
| **B.** | **Active engagement** | | | |
| 8. | I enjoy learning science in group activities. | 3% | 0% | 97% |
| 9. | Visit to science parks or museums improve my understanding in science. | 5% | 7% | 88% |

| | | | | |
|---|---|---|---|---|
| 10. | I am interested in participating in science exhibitions. | 10% | 1% | 89% |
| 11. | I can stay focused if digital tools or videos are used for teaching science. | 3% | 2% | 95% |
| 12. | I receive feedback on my activities in science class. | 8% | 4% | 88% |

All students (100%) agreed that their past experiences helped them to relate to and understand science. High agreement percentages, above 90%, regarding the effectiveness of hands-on experiences in real-world applications, along with the improvement of personal skills, highlight the significant impact of experiential learning in science education (see Table 3). An overwhelming 93% of the students believe that such involvement has relevance beyond the classroom and subject, reinforcing the interdisciplinary value of experiential learning. On the contrary, 97% of the students agreed that project work is stressful. The qualitative analysis further explores the challenges associated with this issue. The majority of students (88% to 97%) perceive educational visits, the use of digital tools, participation in science exhibitions and group activities as enjoyable aspects of experiential learning. Also, a substantial proportion (88%) indicated that they received feedback which facilitated learning improvement. But still a notable fraction (12%) felt they were not adequately supported.

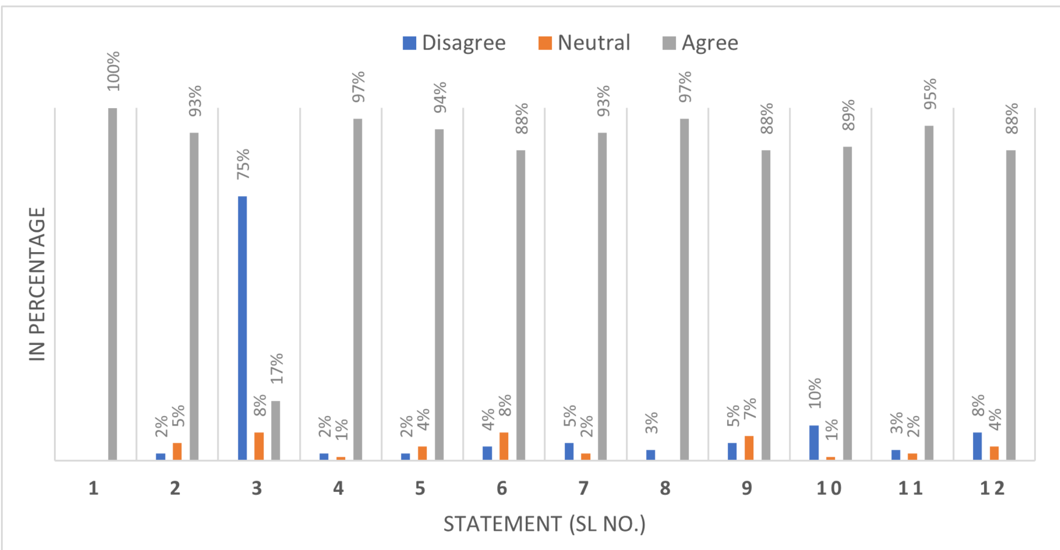


*Figure 3: Students' Perceptions in experiential learning in science at the secondary stage*

## Practices for Implementing Experiential Learning in Science

The third objective is to investigate the on-going practices for implementing experiential learning in science at the secondary stage. The analysis is based on the quantitative analysis of data obtained from a 4-point Likert Scale, administered to teachers and students of respective schools and subjects. Additionally, observations were recorded using a rating scale by the researchers as non-participant observers there. The study was conducted under a few distinct themes (see Table 4).

**Table 4: Implementing interactive experiential learning methods in science**

| S. No. | Items | | | | |
|---|---|---|---|---|---|
| **A.** | **Classroom observation** | **Poor** | **Adequate** | | **Well** |
| 1. | Well-ventilated and having enough light | 0% | 30% | | 60% |
| 2. | Classroom encourages artistic creativity | 0% | 40% | | 70% |
| **B.** | **Interactive and reflective practices as reported by teachers** | **Never** | **Sometimes** | **Mostly** | **Always** |
| 3. | I incorporate hands-on activities or experiments during science lessons. | 3.3% | 13.3% | 73.4% | 10% |
| 4. | I facilitate collaborative works in the science class. | 0% | 6.6% | 46.7% | 46.7% |
| 5. | I provide opportunity to reflect on their activities. | 0% | 13.3% | 46.7% | 40% |
| **C.** | **Interactive and reflective practices as reported by students** | **Never** | **Some times** | **Mostly** | **Always** |
| 6. | My science classes are interactive. | 1% | 41% | 22% | 36% |
| 7. | I conduct experiments or activities in the science class. | 5% | 37% | 35% | 23% |
| 8. | I am taught science using hands-on materials. | 5% | 36% | 33% | 26% |
| 9. | The activities mentioned in chapters, covered in the science books, are performed. | 12% | 25% | 20% | 43% |
| 10. | I get the opportunity to express freely in the classroom. | 4% | 16% | 20% | 60% |
| 11. | I get the opportunity to reflect on activities. | 6% | 22% | 21% | 51% |
| **D.** | **Interactive and reflective practices observed** | **Yes** | **Partially** | | **No** |
| 12. | Engaging introduction | Yes (60%) | Partially (40%) | | No (0%) |
| 13. | Real and relevant examples from the surroundings are provided. | Yes (70%) | Partially (30%) | | No (0%) |
| 14. | Appropriate TLMs are used for the effective understanding of learners. | Frequently (50%) | | Often (30%) | Rarely (20%) |
| 15. | ICT resources are used in transactions. | Frequently (60%) | | Often (30%) | Rarely (10%) |
| 16. | Making learning enjoyable. | Frequently (70%) | | Often (30%) | Rarely (0%) |
| 17. | Teachers simultaneously attend to learners' needs. | Frequently (60%) | | Often (20%) | Rarely (20%) |

Table 4 indicates a positive classroom environment with good ventilation and lighting (70%), along with the encouragement of artistic creativity (60%) through colourful diagrams and illustrations on walls and charts made by students. Science classes are generally interactive, with 58% of the students frequently expressing themselves and 73% engaging in reflective activities. Teachers regularly incorporate hands-on activities (73.4%). However, there is a gap in consistently facilitating collaboration and providing reflective opportunities, with only 46.7% doing so frequently. Observations confirm engaging introductions (60%), frequent use of real-world examples (70%), use of appropriate TLMs (50%) and ICT resources (60%), contributing to an enjoyable learning experience (70%). However, 20% of the teachers rarely address all learners' needs, highlighting a need for improvement.

**Table 5: Evaluation practices in experiential learning in science**

| Sl. No. | Items | | | | |
|---|---|---|---|---|---|
| **A.** | **Evaluation practices as reported by teachers** | **Never** | **Sometimes** | **Mostly** | **Always** |
| 1. | I encourage learners to design their own activities. | 0% | 33.6% | 36.4% | 30% |
| 2. | I expose learners to real-life situations during science lessons. | 3.4% | 3.4% | 46.6% | 46.6% |
| **B.** | **Evaluation practices as reported by students** | **Never** | **Some times** | **Mostly** | **Always** |
| 3. | I apply scientific concepts to real-world problems in class. | 1% | 26% | 30% | 43% |
| 4. | I have participated in science experiments or activities outside class. | 13% | 44% | 22% | 21% |
| **C.** | **Evaluation practices as observed** | **Frequently** | | **Often** | **Rarely** |
| 5. | Discussion of projects, activities post lesson. | 57% | | 29% | 14% |
| 6. | Teacher connects subject beyond science. | 20% | | 70% | 10% |
| 7. | Main focus on memorising answers. | 30% | | 70% | 0% |
| 8. | Scope for sports-integrated pedagogy. | 0% | | 0% | 100% |
| 9. | Facilitating students' problem-solving skills. | 40% | | 50% | 10% |

Table 5 highlights discrepancies in evaluation practices in experiential learning in science education. Teachers reported that they facilitate learning while allowing learners to design activities mostly (36.4%) and often expose them to real-life situations (46.6%). However, from the students' perspective, applying scientific concepts to real-world problems is prevalent (43% always), stating that they 'always' do so. However, participation in science activities outside the classroom is less consistent, with only 21% reporting that they 'always' engage in such activities. Observations revealed a strong focus on connecting subjects beyond science (70% 'often') and post-lesson discussions (57% 'frequently'). However, there is a concerning reliance on memorisation (70% 'often') and a complete lack of sports-integrated pedagogy (100% 'rarely'). These findings indicate robust real-world applications and follow-up activities but also reveal a significant reliance on rote learning and a lack of interdisciplinary approaches involving sports.

## Challenges in Planning and Implementing Experiential Learning EL in Science

The third objective, which examines the challenges, perceived by teachers in implementing experiential learning science, analyses qualitatively using data collected from open-ended questions in survey questionnaires. The major themes and respective interpretations are presented as follows.

(a) **Administrative challenges**: Teachers perceived the implementation of experiential learning as not cost-efficient due to inadequate funding. One teacher expressed, "I see financial burden in getting the necessary TLMs and securing funds for activities like excursions as a major challenge." Another teacher highlighted, "The lack of autonomy is an issue." The teachers further underlined limited time to syllabus completion and preparation for summative exams as a significant challenge. As a result, the lack of appropriate support and availability of resources make activities like project work stressful.

(b) **Perception of burden**: The shortage of teaching staff and high pupil–teacher ratio are perceived as major challenges in implementing experiential learning. One teacher noted, "The non-educational burden on teachers is an issue." Another emphasised, "The lack of appropriate CPD* is a major challenge", which can be linked with the perceptions on ATL and the view of activities as complimentary to conventional teaching.

(c) **Manpower mobility**: Three teachers identified this as a challenge in the context of experiential learning. One teacher stated, "I have noticed the lack of adequate and qualified personnel is a challenge in our experiential learning programmes." Another shared, "The frequently changing positions and deputations can disturb continuity in experiential learning."

(d) **Integrating lab with classroom**: The integration of laboratory with the classroom is crucial for experiential learning in science. One teacher noted, "In science, integrating the lab with the classroom will ensure simultaneous experimentation during lessons." Additionally, the establishment of subject-specific laboratory is a major concern. Another teacher highlighted this by stating, "Having a dedicated lab space for each subject ensures the availability of relevant materials for the practical application of theoretical concepts."

(e) **Complexity**: The teachers' perceived experiential learning as a complex system, which needs a different assessment approach. One concern they shared was the reluctance of students to participate in activities. One teacher noted, "The experiential approach to science education may slow down the curriculum."

## Discussion

The present research provided valuable insights into the current state and perceptions surrounding experiential learning in science education in government schools. The study revealed gap between the availability and accessibility of basic infrastructure compared to resources for curricular activities in providing essential resources crucial for the holistic development of students (see Figure 1). While co-curricular programmes and science exhibitions are prevalent, academic excursions are notably absent (see Table 1). Teachers perceive experiential learning as effective, aligning with findings in NEP 2020 and the National Curriculum Framework for Secondary Education 2023 (NCFSE 2023). However, uncertainties exist about certain methods, for example ATL, sports-integrated approach and hands-on learning, indicating a need for appropriate professional training, which is in support of studies conducted by Zhang and Campbell (2012) and Ernst (2013).

The unanimous agreement among students regarding the impact of their past experiences in understanding science, coupled with high agreement percentages in favour of hands-on experiences and curricular activities, underscores the instrumental role of experiential learning in science education. These findings align with the research of Burch, et al. (2016), Ergul, et. al. (2012) and Bates (2014). However, contrary to the recommendations of NEP 2020, which emphasise interdisciplinary approaches, especially the integration of sports, the continued reliance on rote learning and the absence of such approaches do not align with the findings of Beane (1997) and Dewey (1938), highlighting areas for improvement. The challenges faced by teachers in implementing experiential learning further elucidate administrative (Austin and Rust, 2015), perception-related and complexity-related difficulties, as explored in studies conducted by Kong (2021) and Funa and Prudente (2021). Addressing these challenges is essential for the effective implementation of experiential education in government schools of Mayurbhanj.

## Conclusion and Educational Implications

The findings of this study highlight the strengths and weaknesses in infrastructure, resources, and the implementation of curricular activities, highlighting the need for improvements in various areas, such as accessibility and curricular opportunities. Despite the challenges faced by teachers and students, there is positive perception of integrating experiential learning in science at the secondary stage.

While there is a strong emphasis on effective practices, including hands-on activities and real-world applications, significant gaps can be found in collaboration, reflective opportunities and addressing the diverse needs of learners. Addressing infrastructure gaps, providing resources, reducing the overreliance on rote memorisation, promoting interdisciplinary approaches, catering to all learners, and conducting teacher trainings are crucial. By leveraging these insights, an environment conducive to experiential learning can be created, consequently empowering students and fostering their overall development.

This study aims to provide an overview of the status of infrastructure, teacher and student perceptions, and current practices in implementing experiential science education at the secondary stage in Mayurbhanj district. It also explores the challenges perceived by teachers, which can help identify the necessary infrastructure and professional support required. The insights gained from students' and teachers' perceptions will offer a comprehensive understanding of the readiness towards the implementation of experiential learning and provide guidance for improvement at the ground level.

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