A CASE STUDY ON THE EFFECTIVENESS OF ATAL TINKERING LABS IN MYSORE SCHOOLS

Research Paper

ABSTRACT

Atal Tinkering Labs (ATLs) have been introduced in Indian schools to foster a culture of innovation and STEM learning. This study examined the establishment, management, and impact of ATLs in three Mysore schools. Using a qualitative case-study approach, data were collected through questionnaires, interviews, and observations. Findings indicated that ATLs enhance students' creativity, problem-solving skills, and interest in STEM fields. Teachers acknowledged the positive impact of ATLs, though challenges such as resource management and interdisciplinary collaboration persist. The study suggested policy enhancements to maximise ATL effectiveness in fostering innovation.

Keywords : *Atal Tinkering Labs, STEM Education, Innovation, Case Study.*

Introduction

The ancient Indian proverb, 'Swadeshe pujyate raja, vidwan sarvatra pujyate', meaning 'a king is revered only within his land. Still, educated people are revered everywhere, reflecting education's historical significance in India. India's educational system is extensive and multifaceted, educating more than 260 million students in 1.5 million schools and employing 8 million teachers, directly influencing nearly one-fifth of the world population (National Policy on Education, 2020). Even though India had a history of great scientists and engineers, the conventional rote learning system consistently undermined creativity and practical knowledge. The prompted structural changes ensured that education aligned with industrial requirements, and there was a convergence between technology adoption and innovation.ATLs under the Atal Innovation Mission (AIM) by NITI Aayog were created to bridge this divide and promote hands-on innovation. These labs offer experiential learning, enabling students to form computational thinking, design thinking, and problem-solving skills through practical applications, which fits the National Education Policy (NEP) 2020 focus on skill-based education. The India STEM Foundation also provides this through educating young kids in science and technology through robotics and funding ATLs. With an emphasis on technology and entrepreneurial exposure in the early years, such programs are geared to develop a generation of innovative professionals poised to meet the increasing demand for STEM professionals. The current study examined specifically the efficacy of ATLs among Mysore schools to inculcate innovation and scientific temper among students.

Rationale of the Study

The Atal Tinkering Lab (ATL) initiative, launched by the Government of India, aims to equip students with critical thinking, problem-solving, and computational skills to prepare them for future careers. ATLs provide hands-on learning resources, fostering creativity and innovation among students. However, gaps remain in technical skill development in schools. This study assessed the effectiveness of ATL solutions in Mysore schools, examining their implementation, impact, and alignment with their intended objectives. Evaluating ATL's progress is crucial to ensure it effectively nurtures innovation and skill-based learning.

Objectives of the Study

i. To study the various aspects related to the establishment of ATL in schools.

ii. To describe the management and functioning of ATL in schools.

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iii. To infer various innovations created in the ATL in schools.

iv. To determine students' opinions regarding ATL.

v. To analyse teachers' opinions regarding ATL.

Background of the Study

STEM education is essential in equipping students with the skills necessary for the changing labour market, with experiential projects such as makerspaces and tinker labs improving motivation and analytical abilities. Incorporating STEM activities into the curriculum enhances critical thinking and builds students' readiness for college and STEM careers. Exposure to STEM early has a significant impact on subsequent career options (Adelman, 1998, 1999; Federman, 2007; Lowell et al., 2009). Developing a STEM-literate society involves prioritising content knowledge, cultivating attitudes, and developing skills to solve real-world issues (Bybee, 2013). Encouraging interest in STEM happens best at the early years in elementary school, calling for early incorporation of engineering and advanced inquiry concepts (Russell, 1999; Russell, Hancock, & McCullogh, 2007; Swift & Watkins, 2004).

STEM Initiatives and Current Status in India

Government of India actively encourages scientific temperament through different STEM schemes, such as the National Children's Science Congress (DST, 1993), INSPIRE Program (DST, 2008), IRIS Program (2006), Science Express (2007), and the Jawaharlal Nehru National Science, Mathematics, and Environment Exhibition (NCERT, 1971; Science Exhibition, 2017). The Atal Innovation Mission's Atal Tinkering Laboratories (ATLs) enable experiential STEM education for classes 6-10 (NITI Aayog). The National Education Policy 2020 (NEP, 2020) enshrines this promise through experiential learning, critical thinking, and interdisciplinary education, with initiatives such as minimising rote learning, embracing AI and Design Thinking, and computational thinking and coding at a young age. As India aspires to become a global innovation leader, some challenges still exist, such as teacher training shortcomings and the dominance of rote learning (Ministry of Education, 2020; ASER Centre, 2022). Although efforts such as ATLs are opening up access further, particularly for girls and disadvantaged communities (NITI Aayog, 2023), the digital divide restricts access in rural regions (UNESCO, 2021). NEP 2020's emphasis on vocational and multidisciplinary skills will close the gap between industry and academia (Ministry of Education, 2020), while institutions such as IITs and IISERs are major contributors to STEM research and graduates. However, more funding and industry partnerships are required (Department of Science and Technology, 2023). Comparative international research has pointed towards the effectiveness of inquiry-based learning in STEM, like ATLs, but a comparative analysis of ATLs in India is essential.

Methodology

A qualitative case study approach focused on three Mysore schools with operational ATLs. Data collection methods included questionnaires for students and teachers to assess ATL effectiveness, interviews with ATL coordinators, teachers, and school administrators, observations of ATL activities, infrastructure, and student participation and a checklist for tools and equipment present in the ATL. The investigator selected three schools with functional ATLs for the study.

Findings and Discussion

Establishment and Infrastructure

The research indicated that all three schools effectively satisfied the ATL setup guidelines, acquiring the necessary space, tools, and equipment due to funding from the Atal Innovation Mission. Even so, minor setbacks such as delays in equipment purchase and teacher training affected the initial adoption in some schools. Lab space differed dramatically, with School A having more than 1500 sq ft, whereas Schools B and C had modest but properly equipped, functional areas. No matter the size, all schools made efficient use of their facilities, allowing students to engage in STEM activities actively.

Student Engagement and Learning Outcomes

Students were highly interested in ATL activities, especially in robotics, coding, and electronics. Practical learning stimulated critical thinking, problem-solving, and the implementation of theoretical concepts to practical problems. Students worked on innovative projects,

demonstrating their creativity and technical expertise. Some impressive prototypes were an EMG-powered prosthetic arm for the blind, a plant monitoring system for agriculture, and IoT-based smart vacuum cleaners and automatic lawn mowers. Engagement in ATL also resulted in greater participation in STEM competitions and a higher inclination toward STEM careers, contributing significantly to students' academic interests and aspirations through exposure to advanced technology and real-world problem-solving.

Teachers' Perspectives

Teachers across the board attest to the revolutionary effect of Atal Tinkering Labs (ATLs) on learning Science, Technology, Engineering, and Math (STEM) education, speaking about how ATLs make learning more experiential, interactive, and engaging and deeper than from textbooks. The hands-on learning provided by ATLs equips students with practical skill sets, which supplement theoretical knowledge.There are challenges, though, especially in reconciling ATL learning with the regular curriculum. Certain teachers, particularly those from non-STEM subjects, were apprehensive that students would give prominence to ATL projects in comparison to other subjects such as social sciences and languages. School administrators advise an interdisciplinary methodology by incorporating STEM activities with social sciences and humanities to counteract this. Teachers also advocate for regular training sessions to familiarise themselves with the skills to implement ATL-based learning in their classroom teaching seamlessly and uniformly, making the entire learning experience cohesive.

Challenges and Areas for Improvement

Atal Tinkering Labs (ATLs) have been able to promote creativity and innovation; some challenges need to be dealt with to continue their success. There is limited engagement of non-STEM teachers, indicating a necessity for increased interdisciplinary collaboration to infuse tinkering across disciplines. Ongoing funding for upkeep and refreshments is also a significant challenge; schools find it difficult to obtain ongoing resources after the initial grant, and hence, the necessity for collaborations and alternative funding schemes. Lastly, there is a requirement for improved documentation of student innovations. Most pioneering projects have inadequate records, and hence, monitoring progress and being able to display student achievements is challenging. Formalised repositories for student work would facilitate the acknowledgement of efforts and stimulate future innovators.

Conclusion

Atal Tinkering Labs (ATLs) have significantly influenced STEM education by promoting experiential learning, creativity, and problem-solving skills in students. The labs have effectively developed a culture of innovation and positively impacted students' academic and career aspirations. In order to further improve their impact, some important areas require attention. Teacher training is important to incorporate ATL activities seamlessly into the curriculum. Encouraging interdisciplinary collaboration between teachers and providing sustained funding are critical to sustain and build ATL infrastructure and resources. Moreover, undertaking longitudinal studies will yield helpful information on the long-term influence of ATLs on student development and career aspirations. By embracing inclusivity and responding to these recommendations, ATLs can remain a catalytic influence in education, overcoming the divides between theory and practice and equipping students to be future creators.

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A gifted teacher is not only prepared to meet the needs of today's child but is also prepared to foresee the hopes and dreams in every child's future.

- Robert John Meehan.

A teacher is a compass that activates the magnets of curiosity, knowledge, and wisdom in the pupils

- Ever Garrison

The great teacher is not the man who supplies the most facts, but the one in whose presence we become different people.

- Ralph Waldo Emerson

The task of the excellent teacher is to stimulate 'apparently ordinary' people to unusual effort. The tough problem is not in identifying winners: it is in making winners out of ordinary people.

- K. Patricia Cross

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