CHAPTER- I

INTRODUCTION

1.1 Introduction

Connecting tinkering, technology, and innovation to societal results would propel India forward economically and socially. To put India on the global map of innovation, a slew of structural reforms is being implemented. Strong ties are being established between academia, government, and industry in order to create an enabling environment that not only breeds scientific aptitude that leads to innovation, but also nurtures a creative and innovative mindset in children at an early age, in order to accelerate growth for a New India. The old Indian education system had failed to meet the industry's rapidly changing needs thus it was critical that school education in India be reinvented with innovation. India's first and largest government-led initiative, launched to disrupt the Indian education system and equip young students with 21st-century skills such as creativity, innovation, critical thinking, social and cross-cultural collaboration, ethical leadership, and so on, in order to build a New India.

As per National Education Policy, 2020 of India, the world is undergoing rapid changes in the knowledge landscape. With various dramatic scientific and technological advances such as machine learning and artificial intelligence, the need for a skilled workforce, particularly involving mathematics, computer science and data science will be in greater demand. Education should provide opportunities to be creative and innovative. Pedagogy must evolve to make education more experiential, holistic, integrated enquiry driven, discovery-oriented. Atal Tinkering labs provide such opportunities to the students. The students learn by doing and are encouraged to develop new understandings while refining their ideas (Mooney and Laubach 2002). To develop 21st century skills among students like critical thinking, problem solving, computation, creativity, Atal Tinkering Labs are being established in various Government and private schools in India. At present more than 5000 ATLs are functional in India. ATLs are 1200 to 1500 square feet area dedicated to endorse STEM education by providing innovative workshops where do it yourself kits on latest technologies like 3DPrinter, Robotics, internet of things is available, but content of other disciplines. They must be capable of creating an educational environment that allows students to solve problems while deepening their content knowledge.

India is a developing country and needs more citizens to adopt STEM related careers as their occupation as it is fast growing and best paid. To create interest of the young generation in STEM related subjects and to develop a culture of innovations, ATLs provide the best platform. In order to promote STEM (Science, Technology, Engineering and Mathematics) Education, Atal Innovation Mission (AIM) is a flagship initiative of the Niti Aayog, Government of India by establishing ATAL Tinkering Labs (ATLs) in schools. ATLs are the workspaces where young minds can give shape to their ideas through hands-on activities. Atal Tinkering Lab is a physical space in the vicinity of school equipped with the education technology in the world. Its vision 'Tinkering in schools' became a celebration of creativity and expression of knowledge generation in all stakeholders.

On January 1, 2015, the Union Cabinet passed a resolution creating the National Institution for Transforming India, better known as NITI Aayog. NITI Aayog is the Government of India's top policy "Think Tank," providing both directional and policy suggestions. NITI Aayog gives relevant technical assistance to the Centre and States in designing strategic and long-term policies and programmes for the Government of India. In keeping with its reform objective, the Indian government established the NITI Aayog to replace the Planning Commission, which was established in 1950. This was done in order to better serve the people of India's needs and ambitions. NITI Aayog, a significant departure from the past, serves as the Government of India's central platform for bringing states together in the national interest, fostering cooperative federalism.

The Atal Innovation Mission (AIM) is the Government of India's flagship programme, based at the NITI Aayog, to foster innovation and entrepreneurship across the country. By incentivizing the promotion of an ecosystem of innovation and entrepreneurship at various levels - higher secondary schools, higher educational and research institutions, and SME/MSME industry, corporate, and government ministerial level - AIM under NITI Aayog is envisioned as an umbrella innovation organisation that would play an instrumental role in aligning innovation policies between central, state, and pectoral ministries. The primary goal was to establish an institutional structure that would foster innovation and an entrepreneurial mindset. AIM fosters innovation at the school level through the Atal Tinkering Labs (ATL), where students may experience design thinking and broaden their intellectual horizons while seeking solutions to everyday challenges and showcasing their creations on recognised platforms. Another citizen-led national initiative spearheaded by AIM is the Mentor of Change (MoC) Program, in which trained professionals provide pro-bono mentoring to young ATL

innovators with a strong sense of country building. The Atal Incubation Centres (AICs) of AIM are building world-class ecosystems for start-ups to thrive, including the necessary handholding such as mentoring and investor networks. AIM recognised the need of turning invention into a national movement in which citizens felt responsible for making an effect and contributed to it. This program is inspired by the ancient Indian Gurukul system and Finland's Self-learning methodology. It encourages the students to take hands-on training, real world exposure and self-development. According to the Government of India, 10,000 Atal tinkering labs (ATLs) have already been established in schools across the 722 districts in India. In the recent 2025 annual financial budget, the government announced to set up 50,000 more ATLs over the next five years.

1.2 Statement of the Problem:

The statement of the problem can be stated as **A Study on Awareness of Pupil-Teachers on Atal Tinkering Labs under ATAL INNOVATION MISSION.**

1.3 Research questions:

1. What is the level of awareness of pupil teachers on Atal Tinkering Labs?
2. What is the perception of pupil teachers on ATLs help students to become innovators?
3. How familiar are pupil teachers with the technological tools and coding languages used in ATLs?
4. What are the perceptions of pupil teachers regarding the role of ATLs in promoting innovation, creativity, and 21st-century skills?
5. Do pupil teachers believe ATL-based activities are effectively integrated into the regular school curriculum?
6. What is the interest level of pupil teachers in receiving formal training on ATL-based teaching methodologies?

1.4 Objectives of the study:

1. To study the awareness of Pupil-Teachers on Atal Tinkering Labs.
2. To analyse the perceptions of pupil teachers about the effectiveness of ATLs in fostering innovation, experiential learning, and future employability.
3. To determine the willingness of pupil teachers to undergo professional development through formal ATL training programs.

1.5 Hypotheses:

1. There is no significance difference in awareness on ATL among pupil teachers of B.A B.Ed, B.Ed, B.Sc B.Ed. ITEP, B.Ed-M.Ed Integrated.
2. There is no significance difference in perception on ATL among pupil teachers of B.A B.Ed, B.Ed, B.Sc B.Ed. ITEP, B.Ed-M.Ed Integrated.

1.6 Need for the study:

The Government of India has launched many schemes for Startups and Entrepreneurship. This study helps to understand the awareness of pupil teachers on Atal Tinkering Lab under Atal Innovation Mission and their perception on fostering innovation, experiential learning, and future employability through ATLs. Several studies assess ATL's impact on student outcomes, few examine pre-service teacher readiness both in terms of awareness and perception to implement ATL pedagogy. This research addresses that lacuna by providing empirical evidence on how prepared future teachers are to leverage ATL in classroom settings.

The NEP 2020 emphasizes experiential, inquiry-driven learning and integrating technology into classrooms. Understanding pupil-teachers' baseline ATL knowledge is crucial for designing teacher-preparation programs consistent with this policy. With AIM aiming to add 50,000 new ATLs over five years, there is an urgent need to ensure that incoming teachers can facilitate ATL activities. This study's insights can inform targeted professional-development initiatives to scale ATL effectively. Establishing a culture of tinkering at the school level requires teachers who are confident in guiding hands-on, STEM-focused projects. By identifying awareness gaps and perception differences across programs, policymakers and teacher-educators can develop customized interventions, ensuring ATL initiatives translate into tangible, sustainable innovation ecosystems.

This study extends existing literature by employing a combination of descriptive and inferential analyses (ANOVA) to discern not only overall patterns but also program-specific variations an approach not widely used in prior ATL research.

1.7 Delimitations of the Study:

Data collection was confined to pupil-teachers at RIE Bhopal (Bhopal region). Hence, findings may not generalize to teacher-education programs in other states or rural institutions.

Only pre-service pupil-teachers participated; the study did not include ATL In-charges, in-service teachers, or students working within ATLs, which limits understanding of stakeholder perspectives beyond the pre-service cohort.

A convenience sample of 100 pupil-teachers was used, restricting statistical power for subgroup analyses beyond the five course categories. Results may not accurately represent all pupil-teachers in similar programs.

The study relied solely on self-reported questionnaire data (awareness and perception), without observational or qualitative triangulation (e.g., focus groups), which may introduce social-desirability bias.

Data were collected during a single academic year (2024–2025), so longitudinal changes in awareness/perception over time remain unexplored.

1.8 Operational Definitions of Key Terms:

Pupil-Teacher: A pupil-teacher refers to a pre-service teacher enrolled in teacher-education programs (e.g., B.Ed., B.Sc. B.Ed., ITEP) who is being trained for future roles as a professional educator.

Awareness: Awareness in this study refers to the extent of knowledge and familiarity that pupil-teachers have about Atal Tinkering Labs, including their objectives, structure, tools, and functioning.

Tinkering: Tinkering denotes the process of hands-on experimentation, trial-and-error learning, and creative problem-solving that students engage in while using tools and technologies in ATLs.

Atal Tinkering Labs (ATL): ATLs are innovation workspaces established under the Atal Innovation Mission where students explore STEM concepts through DIY projects involving tools like 3D printers, robotics kits, and coding platforms.

Perception: Perception refers to pupil-teachers' attitudes, beliefs, and opinions about the role, usefulness, and impact of ATLs on student learning and innovation development.

Effectiveness: Effectiveness in this context refers to how well ATLs achieve their intended outcomes, such as fostering creativity, enhancing experiential learning, and developing 21st-century skills among students.

Innovation: Innovation is defined as the ability to generate novel ideas, products, or processes by applying creative thinking and practical skills, often facilitated through ATL activities.

Experiential Learning: Experiential learning is a hands-on, student-centered learning approach where learners gain knowledge and skills through direct experience, reflection, and real-world application in ATLs.

Employability: Employability refers to the readiness and skillset of students to enter and succeed in future job markets, particularly in STEM fields, as influenced by their exposure to ATL-driven activities.

Professional Development: Professional development indicates ongoing learning opportunities (formal or informal) for pupil-teachers to acquire the competencies needed to implement ATL-based pedagogies effectively.

ATL Training Programs: ATL training programs are structured workshops or courses designed to equip teachers and pupil-teachers with practical knowledge, technological skills, and instructional strategies for managing ATL environments.