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Atal tinkering labs in district Kathua: Assessing accessibility and exclusion of far-flung schools

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Abstract
This qualitative study explores the functioning, challenges, and impact of Atal Tinkering Labs (ATLs) in government schools located in the far-flung area of Kathua District, Jammu and Kashmir. The study focuses on how these innovation labs are being implemented in remote schools, where infrastructure and resources are often limited, and examines their influence on the development of creativity, critical thinking, and problem-solving skills among students. The study aims to assess the experiences and perceptions of both teachers and students towards the use of ATLs, exploring their engagement with technology and hands-on learning. Data were collected through semi-structured interviews and field observations involving school principals, ATL in-charges, science teachers, and students. The findings indicate that while ATLs have the potential to enhance students' interest in STEM education and innovation, there are significant barriers to their effective implementation. These include a lack of adequate training for teachers, inconsistent supply of materials and equipment, and challenges related to the remoteness of the schools. The study concludes with recommendations for improving ATL sustainability in rural areas, including the need for better teacher training programs, consistent infrastructure support, and stronger local community involvement. This research aims to contribute to the broader understanding of ATL effectiveness in underserved regions and inform future policies on innovation in education.

Keywords: Atal tinkering labs, innovation in schools, educational challenges

Introduction

Education in the 21st century increasingly emphasizes innovation, creativity, and problem-solving skills to prepare students for a rapidly evolving technological world (Phatak and Mane, 2022, p.53) [7]. In response to this need, the Government of India launched the Atal Innovation Mission (AIM), under which Atal Tinkering Labs (ATLs) were established in schools to cultivate curiosity, critical thinking, and design-based learning among students (Pawar, 2024, p.17). These labs are equipped with modern tools such as 3D printers, robotics kits, electronics, and sensors, aiming to empower young minds to become future innovators (Mishra and Gupta, 2023, p. 136) [3]. However, the equitable distribution and accessibility of such facilities remain a significant challenge in many parts of India, especially in geographically remote and socioeconomically disadvantaged areas. District Kathua, situated in the Union Territory of Jammu and Kashmir, presents a stark example of this gap. While six institutions in the district currently have operational ATLs, including Kendriya Vidyalayas, an international school, and a few government higher secondary schools, none of these are located in far-flung or rural areas. This reflects a critical issue of exclusion and disparity in access to innovation infrastructure within the same district (Atal Innovation Mission, Pdf.).

This study seeks to explore this imbalance through a qualitative lens, focusing on the perceptions, experiences, and challenges of stakeholders in far-flung schools of District Kathua. By doing so, it aims to identify the factors that limit the outreach of ATL initiatives in remote regions and offer insights into how these barriers can be addressed through inclusive policy planning and localized interventions. In this context, the present research attempts to shed light on the innovation divide and the need for a more equitable approach to educational development, ensuring that students in remote areas are not left behind in the national mission of nurturing creativity and technological literacy.

Objectives

1. To explore stakeholders' perceptions regarding the implementation of Atal Tinkering Labs in District Kathua.
2. To understand the experiences and challenges of educators and administrators in far-flung schools concerning the absence of Atal Tinkering Labs.
3. To identify policy and infrastructural factors contributing to the exclusion of remote schools from ATL initiatives in the district.

Research Questions

1. What are the perceptions of stakeholders (teachers, students, and administrators) regarding the accessibility and availability of Atal Tinkering Labs in District Kathua?
2. What are the challenges and barriers faced by schools in far-flung areas of District Kathua in accessing or establishing Atal Tinkering Labs?
3. What factors contribute to the exclusion of remote schools from receiving Atal Tinkering Labs, and how can these barriers be addressed?

Research Design

The study follows a qualitative research design, which is suitable for exploring perceptions, experiences, and barriers in-depth.

Methodology

In the present study, Semi-structured interviews schedule was used by the researcher. For the analysis of data, the researcher using thematic analysis, which involves identifying, analyzing and reporting patterns or themes within the data.

Sample and Sampling Technique

In the present study, Purposive sampling technique and small sample was used by the researcher.

Analysis Based on Objective 1

To explore stakeholders' perceptions regarding the implementation of Atal Tinkering Labs in District Kathua

Table 1: Open-ended item

Statement 1	Teachers	Students	Principal	Total
What is your understanding of the Atal Tinkering Lab (ATL) initiative?	10	10	10	30

Table 1 presents the responses of respondents regarding their understanding of the Atal Tinkering Lab initiative. The following responses are: -

- ATL is a platform provided by NITI Aayog to promote innovation and creativity among students by giving them access to tools like 3D printers, robotics kits, and computers (Teachers).
- It's a cool lab where we make models and try new ideas, like making a smart irrigation system (Students)
- ATL aims to nurture curiosity and problem-solving skills among students by providing space and support for hands-on learning (Principal).

Table 2: Open-ended Item

Statement 2	Teachers	Students	Principal	Total
How do you view the implementation of ATLs in your school or locality?	10	10	10	30

Table 2 presents the responses of respondents regarding their views on the implementation of ATLs in their schools or locality. The following responses are: -

- The implementation has been positive, but there's a lack of regular training and follow-up support for teachers (Teachers).
- It was exciting at first, but we don't get enough time to use the lab regularly (Students)
- We received equipment and an initial fund, but maintaining the lab and sustaining activities is still a challenge due to lack of technical staff (Principal).

Table 3: Open-ended item

Statement 3	Teachers	Students	Principal	Total
What changes, if any, have you noticed after the introduction of ATLs?	10	10	10	30

Table 3 presents the responses of respondents regarding changes, if they have noticed after the introduction of ATLs. The following responses are:

- Students have become more curious and confident in presenting their ideas (Teachers)
- They now participate in science exhibitions and competitions. Earlier, they didn't get such opportunities (Students).
- There is increased interest among students in STEM subjects, and they have started thinking more creatively (Principal).

Table 4: Open-Ended Item

Statement 4	Teachers	Students	Principal	Total
How do students and teachers engage with ATL facilities where available?	10	10	10	30

Table 4 presents the responses of respondents regarding students and teachers engage with ATL facilities where available. The following responses of respondents are: -

- Some teachers take initiative and use the ATL actively, but others feel hesitant due to lack of technical expertise (Teachers).
- We go there once or twice a week in small groups and work on projects, especially before competitions (Students).
- Engagement is mostly project-based. We need a structured timetable and a dedicated mentor to improve regular usage (Principal).

Analysis based on Objective 2

To understand the experiences and challenges of educators and administrators in far-flung schools concerning the absence of ATLs

Table 5: Open-ended item

Statement 5	Headmasters	Teachers	Administrators	Science Teacher	Total
What challenges has your school faced in setting up or requesting an ATL?	8	8	6	8	30

Table 5 presents the responses of respondents regarding they faced challenges in their schools in setting up or requesting an ATLs. The following responses of the respondents are: -

- Our school applied for an ATL, but we lacked the infrastructure and internet facilities required as per the guidelines (Headmasters).
- We are unaware of the complete process and eligibility criteria. There is also a lack of guidance and support from the authorities (Teachers)
- Due to our location, transportation of equipment and regular maintenance would be difficult even if we get approval (Administrator).
- Budget constraints and limited space in the school building make it tough to set up a full-fledged lab (Science Teacher).

Table 6: Open-ended item

Statement 6	Headmasters	Teachers	Administrators	Science Teacher	Total
How does the absence of an ATL impact teaching and learning in your school?	8	8	6	8	30

Table 6 presents the responses of respondents regarding the absence of an ATLs impact teaching and learning in their schools. The following responses are: -

- Students have limited exposure to hands-on learning. Science and math remain theoretical subjects (Teachers).
- We are unable to encourage innovation or project-based learning due to the lack of proper facilities (Principals)
- Girls in particular miss out on practical STEM experiences, which could boost their interest and confidence (Science Teachers).
- It widens the gap between urban and rural schools, especially in terms of tech-based learning and creativity (Administrators).

Table 7: Open-ended item

Statement 7	Headmasters	Teachers	Administrators	Science Teacher	Total
What steps have you taken or considered to request an ATL in your school?	8	8	6	8	30

Table 7 presents the responses of respondents regarding important steps they have taken or considered to request an ATL in their schools. The following responses are:

- They have written to the district education office but received no response. We're trying again through local MLA support (Headmasters).
- We collected project photos and student achievements to build a case for ATL support and forwarded it through the cluster head (Teachers).
- We are in touch with NGOs and local CSR bodies to either support an ATL or provide alternative STEM resources (Principals).
- We are planning to conduct an awareness drive to involve the community and show the potential of such labs (Science Teachers).

Analysis based on Objective 3

To identify policy and infrastructural factors contributing to the exclusion of remote schools from ATL initiatives in the district

Table 8: Open-ended item

Statement 8	Headmasters	Teachers	Administrators	Total
What infrastructural or policy gaps do you think prevent ATL setup in remote areas?	10	10	10	30

Table 8 presents the responses of respondents regarding they think infrastructural or policy gaps prevent ATL setup in remote areas. The following responses are:

- Most remote schools lack basic electricity, stable internet, and secure classrooms, which are prerequisites for ATL setup (Principals).
- The eligibility criteria require a certain student strength and performance in science, which many remote schools struggle to meet due to dropouts and poor resources (Teachers).
- There's no dedicated fund to help remote schools first reach a 'minimum standard' before applying for ATL. Whereas, some respondents responded that the current ATL guidelines favor well-equipped schools. There's no flexibility for schools that lack infrastructure due to geographical disadvantages (Administrators).

Table 9: Open-ended item

Statement 9	Headmasters	Teachers	Administrators	Total
How responsive have educational authorities been to ATL demands from remote schools?	10	10	10	30

Table 9 presents the responses of respondents regarding educational authorities demands ATLs from remote schools. The following responses are: -

- We've submitted proposals twice, but there has been no feedback or visit from authorities to assess feasibility. Whereas, some respondents responded that officials listen sympathetically during meetings but take no concrete steps afterward (Principals).
- In some cases, district-level officials are supportive, but the final approval depends on national-level norms that ignore local realities (Teachers).
- The response has been inconsistent — schools in towns get preference even if they apply later (Administrators).

Table 10: Open-ended item

Statement 10	Headmasters	Teachers	Administrators	Total
What policy changes would you suggest to improve ATL access in far-flung areas?	10	10	10	30

Table 10 presents the responses of respondents regarding they suggest to improve ATLs access in far-flung areas. The following responses are:

- Introduce a separate ATL category or relaxed norms for remote schools, with focus on mobile or modular labs (Principals).
- Provide infrastructural support (electricity, internet, space) before inviting ATL proposals from such areas (Teachers).
- District-level flexibility in selection criteria and direct mentorship to help remote schools apply effectively. Whereas, some respondents responded that encourage

PPP (Public–Private Partnerships) to fund basic infrastructure where ATL can't be set up immediately (Administrators).

Main Findings

Stakeholders' Perceptions of ATL Implementation (Objective 1)

- Most stakeholders (teachers, students, and principals) have a basic understanding of ATL as a platform to promote innovation and hands-on STEM learning.
- In schools where ATLs are implemented, stakeholders observed positive changes like increased student engagement, curiosity, and participation in innovation-related activities.
- However, irregular use, lack of structured schedules, and insufficient teacher training were reported as limiting factors.

Challenges in Absence of ATL in Remote Schools (Objective 2)

- Schools in remote areas face multiple barriers such as lack of infrastructure, insufficient knowledge of the application process, and minimal administrative support.
- The absence of ATLs has led to a continued dependency on rote learning, limiting students' exposure to creative and practical learning.
- Efforts by some educators to request ATL setup were met with slow or no response, indicating bureaucratic inertia and lack of localized policy support.

Policy and Infrastructural Exclusion Factors (Objective 3)

- The current ATL policy framework assumes a minimum level of infrastructure, which many far-flung schools lack, thus excluding them by default.
- There is a lack of flexibility in ATL eligibility criteria to accommodate geographic, demographic, and resource-based disadvantages.
- Educational authorities' response to ATL demands from remote schools has been generally non-responsive or inconsistent.
- Stakeholders suggested policy reforms such as flexible criteria for remote areas, pre-ATL infrastructural support, and mobile tinkering labs as alternatives.

Conclusions

- Implementation of ATLs in urban or semi-urban schools has shown promise, but a significant digital and innovation divide exists between these and remote schools.
- Structural and policy barriers, including poor infrastructure, rigid eligibility norms, and lack of administrative support are key reasons for the exclusion of far-flung schools from ATL benefits.
- There is an urgent need for context-sensitive ATL policies that recognize the unique challenges of remote areas and prioritize equity in access to innovation infrastructure.
- Capacity building, infrastructural grants, and alternative models (like mobile labs or shared cluster-based ATLs) should be explored to bridge this gap.
- Without inclusive planning and responsive governance, the ATL initiative risks reinforcing existing educational inequalities rather than alleviating them.

References

1. Atal Innovation Mission (List of Operational Atal Tinkering Lab in India). https://aim.gov.in/pdf/_OperationalATLsInIndia.pdf
2. Government of India (NITI Aayog) Attal Innovation Mission. https://aim.gov.in/overview.php
3. Mishra S, Gupta S. Atal tinkering labs and the global notion of STEM education. Shodh Sari-An International Multidisciplinary Journal,2023:2:(04)131-13. DOI: https://doi.org/10.59231/SARI7629
4. Pawar MUR 3. Impact of Participation in Atal Tinkering Labs and Non-ATL Schools on Students' Educational Performance and Socio-Economic Development in Nagpur District. India's Path to a 7 Trillion Economy by, 16. https://ajantaprakashan.in/pdf/International%20Conference_ISBN/English%20Part%20-%20III,%20Marathi%20&%20Hindi%20Part%20-%20I.pdf#page=23
5. Pandey P, Chhabra M. Understanding Different Facets of Atal Tinkering Laboratory: A Preliminary Study. in extended abstracts, 2025, 41. https://episteme10.hbcse.tifr.res.in/docs/epiSTEME-Extended-Abstracts-2025.pdf#page=57
6. Pareek R, Pandey R K Integrating STEM Education with Sustainable Development Goals: A Framework for Innovation and Inclusive Learning in India. In Transformative Approaches to STEAM Integration in Modern Education IGI Global Scientific Publishing, 2025, 285-314. DOI: 10.4018/979-8-3693-7408-5.ch013
7. Phatak A, Mane V. Creativity, innovation, and cross-cultural collaboration in atal innovation mission. International Journal of Academic Research and Development,2022:7(5):53-56. https://www.allstudiesjournal.com/assets/archives/2022/vol7issue5/7-5-35-572.pdf
8. Raina A. Jogeshwar R, Yadav Y, Iyer S. TA to AI: Tinkering Approach to Artificial Intelligence and Computational Thinking Education in Indian Schools. Computational Thinking Curricula in K–12: International Implementations, 2024, 251. https://books.google.co.in/books?hl=en&lr=&id=CkDSEAAAQBAJ&oi=fnd
9. Tripathi E. Atal Tinkering Labs-A Push to Accelerate Entrepreneurial Attitude Among Young Minds in India. https://pdfs.semanticscholar.org/c2a1/6b3c6fb9e6e1d8e32b9bab8f200a8e0a91e5.pdf
10. Yadav P. Asawa, R, Dutta, S, & Manjula, G. School Auditing Dashboard for Effective Monitoring of Atal Tinkering Lab in India. https://ijses.com/wp-content/uploads/2023/05/99-IJSES-V7N4.pdf