SMART LIBRARIES AND MAKERSPACES IN SCHOOL AND COLLEGE LIBRARIES: INNOVATIONS, CHALLENGES, AND THEIR ROLE IN EMPOWERING A VIKSIT BHARAT 2047

- Presented by

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Introduction

⌗ India's education system continues to face deep urban–rural and socio-economic disparities, especially in access to digital infrastructure and modern learning tools.

⌗ Smart libraries redefine traditional libraries through digital catalogs, cloud services, and AI, fostering interactive, learner-centered, and lifelong learning experiences.

⌗ Makerspaces promote hands-on learning using tools like robotics kits, 3D printers, and coding platforms, building creativity, collaboration, and problem-solving skills aligned with 21st-century education.

⌗ National initiatives such as the NEP 2020, Digital India, and Viksit Bharat 2047 emphasize technology-integrated education and equitable access to digital literacy for all learners.

⌗ This study investigates the implementation, usage, and challenges of smart libraries and makerspaces in Kolkata's schools and colleges, offering insights to advance inclusive, technology-driven education in India.

Objectives

⌗ To examine the current status and extent of implementation of smart library systems and makerspaces in school and college libraries in the Kolkata region.

⌗ To compare the adoption, accessibility, and integration of smart technologies between school and college libraries, identifying key innovations and gaps.

⌗ To assess the challenges, training needs, and institutional support required to effectively utilize smart libraries and makerspaces in advancing the goals of Viksit Bharat 2047.

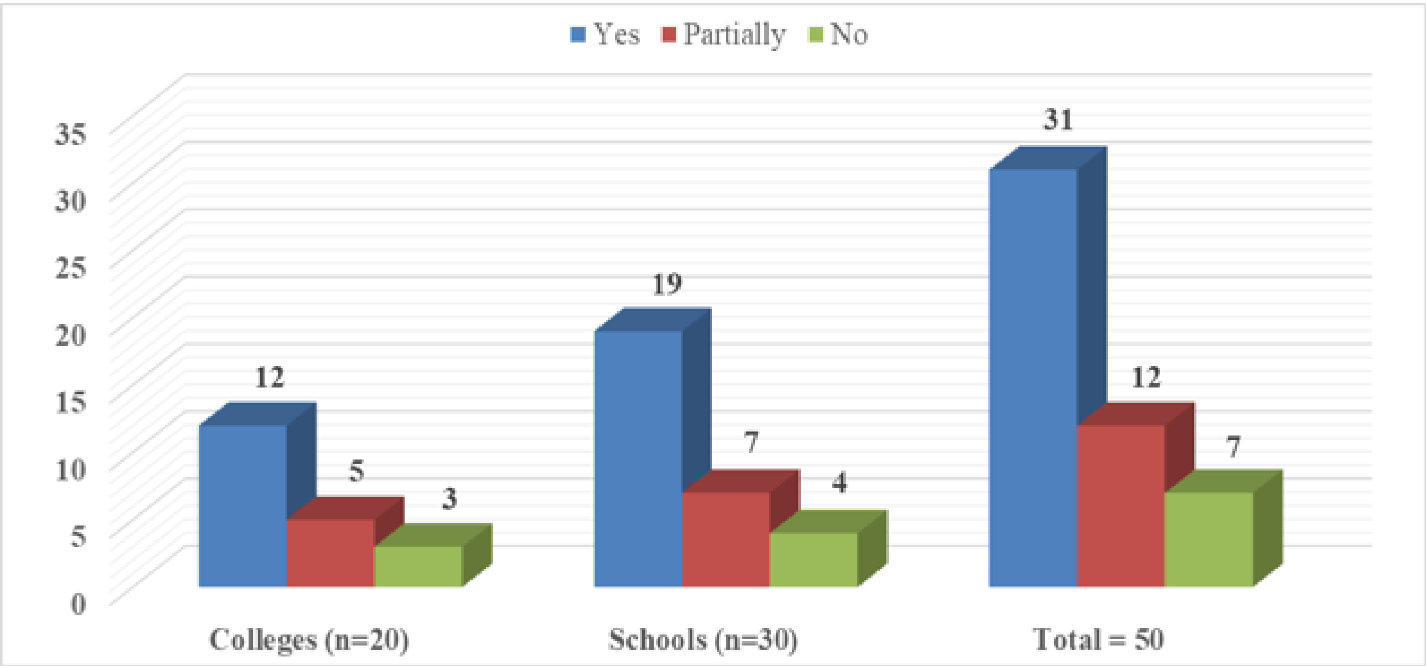
Methodology

- The study adopted a descriptive survey research design supported by a mixed-method approach to analyze smart library and makerspace implementation. Quantitative data were collected through structured surveys, while qualitative insights were drawn from targeted case studies.
- A purposive sampling technique was used to include participants with direct experience in library and educational technology services. The research was conducted in urban and semi-urban schools and colleges across the Kolkata region, ensuring diversity in institutional types.
- The sample size comprised 50 respondents - 30 from schools and 20 from colleges - including librarians, teachers, IT staff, administrators, students, and research scholars.
- Data collection was facilitated through a Google Form questionnaire containing multiple-choice and checklist-based items. Survey questions focused on infrastructure, smart technology availability, curriculum integration, staff training, and external support systems. Data were analyzed using descriptive statistics, comparative analysis, and chi-square tests to assess relationships between institutional type and smart infrastructure.
- The case study component utilized information from official school websites with Atal Tinkering Labs, highlighting the role of makerspaces in educational innovation.
- The study acknowledges limitations related to geographic scope (Kolkata), small sample size, self-reported data, and the exclusion of under-resourced institutions.

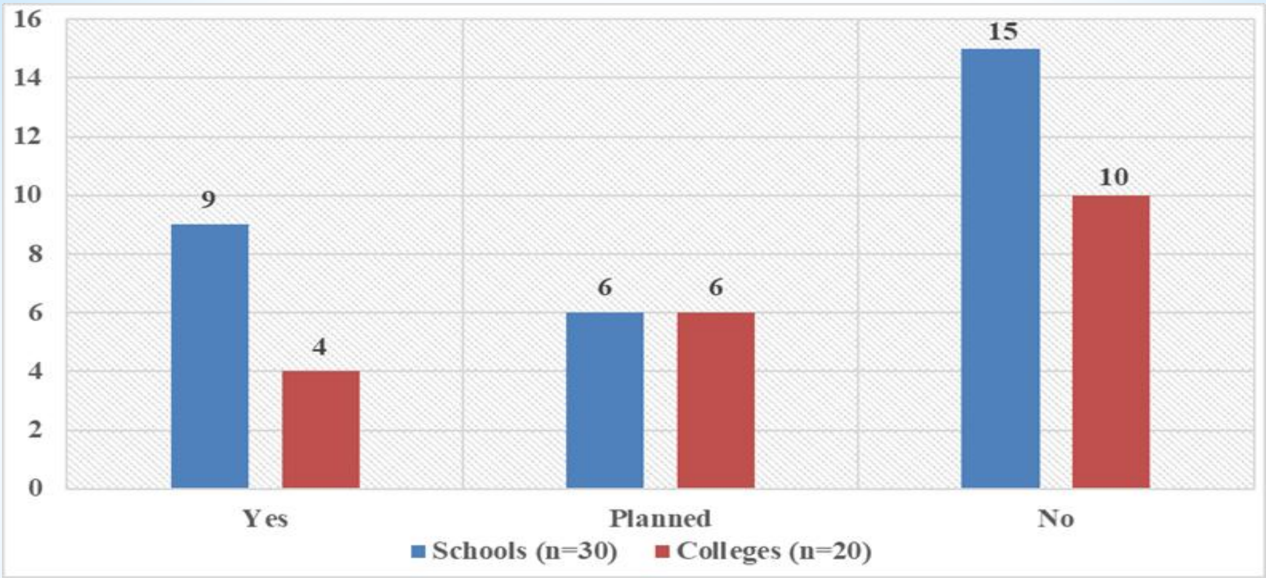
❖ Institutional and Demographic Profile of Respondents

Variable	Category	Frequency (n=50)	Percentage (%)
Type of Institution	School	30	60%
	College	20	40%
Nature of Institution	Government	18	36%
	Private	26	52%
	Semi-Aided	6	12%
Location	Urban	38	76%
	Semi-Urban	12	24%
Years of Experience	Less than 5 Years	20	40%
	5–10 Years	18	36%
	10–20 Years	12	24%

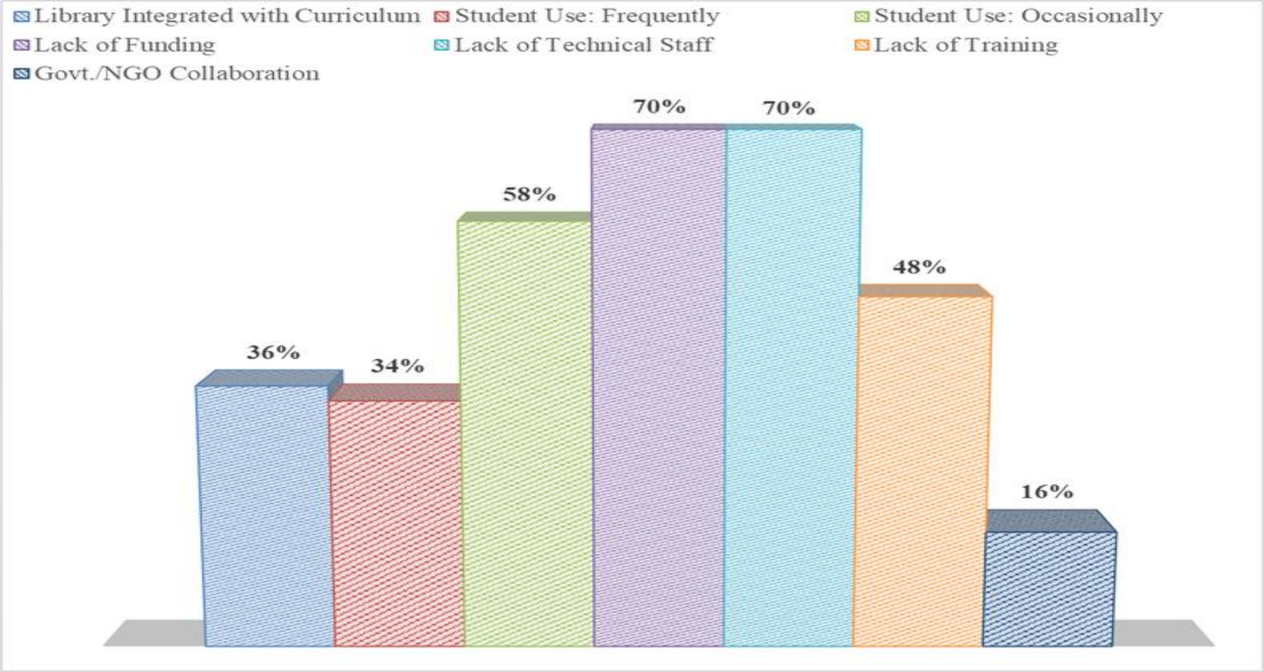
❖ Status of Smart Library Implementation



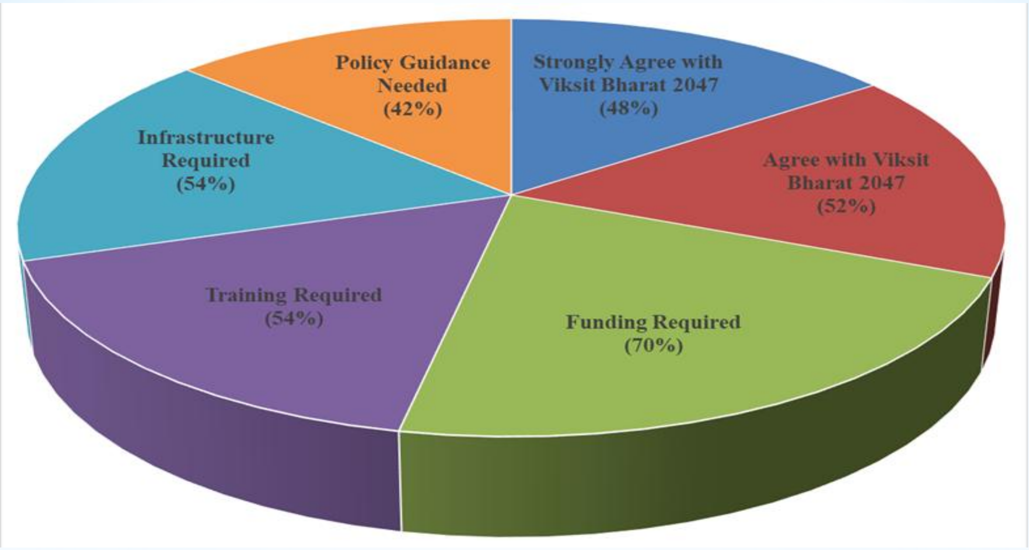
❖ Makerspace/ATL/STEM Lab Implementation



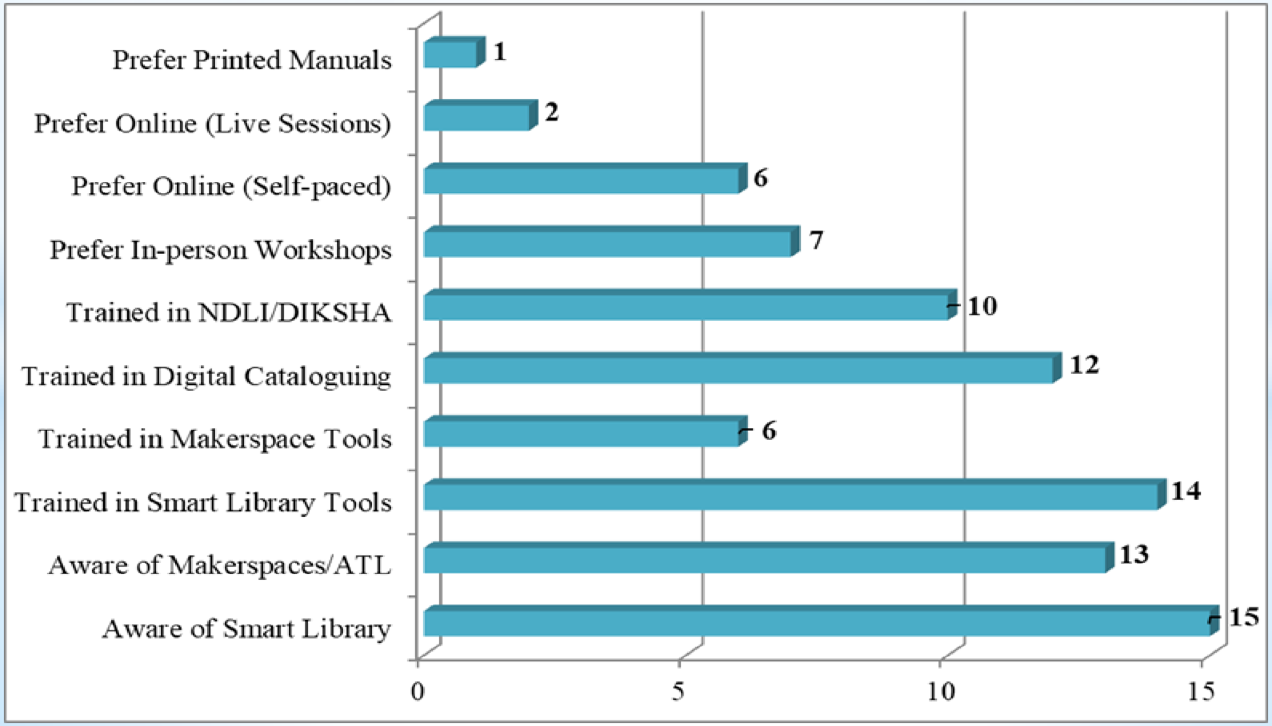
❖ Library Integration, Student Engagement, and Institutional Challenges



❖ Perceptions and Institutional Needs



❖ Awareness and Training Preferences for Smart Library and Makerspace Tools



Chi-Square Test of Independence: Association between Institution Type and Facility Implementation

● Contingency Table for Smart Library Implementation ●

Institution Type	Yes	Partially	No	Total
School (n=30)	19	7	4	30
College (n=20)	12	5	3	20
Total	31	12	7	50

Using the formula above and calculating expected values:

$\chi 2 = 0.059$ Degrees of freedom (df) = (2 - 1) × (3 - 1) = 2 p-value = 0.971

Since, $p > 0.05$, we fail to reject H_0. There is no statistically significant association between institution type and smart library implementation status.

● Contingency Table for Makerspace/ATL Implementation ●

Institution Type	Yes	Planned	No	Total
School (n=30)	9	6	15	30
College (n=20)	4	6	10	20
Total	13	12	25	50

$\chi 2 = 0.962$ Degrees of freedom (df) = 2 p-value = 0.618

Again, with > 0.05, we fail to reject H_0. Institution type and makerspace implementation status are not significantly associated.

This indicates that both schools and colleges face similar levels of implementation, suggesting that infrastructural and resource-related barriers are uniformly distributed. The findings highlight the need for systemic, policy-level interventions rather than institution-specific approaches to advance smart education in alignment with the Viksit Bharat 2047 vision.

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Findings

* 62% of institutions have fully implemented smart libraries, with colleges slightly ahead, though not statistically significant.
* Only 26% have established makerspaces/ATLs, while 24% plan future implementation.
* 35.3% of respondents expressed the need for training in operating smart tools, especially in makerspaces.
* 36% reported full integration of the library with the academic curriculum, while 64% reported only partial integration.
* Only 16% of institutions have partnerships with government or NGOs for support, indicating missed collaboration opportunities.
* Major barriers include lack of funding and technical staff (70.6% each), along with outdated infrastructure and inadequate training.
* 100% of respondents agreed that smart libraries and makerspaces are essential to realizing the Viksit Bharat 2047 vision.

Implications for Stakeholders

* Students: Digital literacy, creativity, and experiential learning, preparing them for future-ready careers.
* Faculty: Innovative pedagogy, research, and interdisciplinary collaboration.
* Librarians: Shift from custodians of collections to facilitators of technology-driven, user-centered services.
* Institutional Leaders and Policymakers: Urgency of sustainable funding, infrastructure, and staff training to scale these initiatives.

Recommendations and Future Research

* Mandate and fund makerspace setups through UGC, AICTE, and NITI Aayog support.
* Institutionalize regular training for librarians and educators in STEM and digital tools.
* Promote public-private partnerships for infrastructure, training, and resource sharing.
* Develop best-practice models to integrate smart libraries into academic curricula.
* Conduct longitudinal and comparative studies to evaluate impact and stakeholder perceptions.

Conclusion

* Smart libraries show moderate adoption (62%), while makerspaces remain limited (26%), with similar infrastructural challenges across schools and colleges.
* Respondents recognize the transformative potential of these innovations toward achieving the Viksit Bharat 2047 vision.
* The study emphasizes that Indian institutions often underprioritize libraries as innovation hubs despite growing adoption.
* It calls for systemic investment, policy support, and capacity-building to reposition libraries at the core of 21st-century education.

Thank You