



Beyond Access: Digital Learning, Pedagogical Change, And Inclusive Education in Odisha

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ABSTRACT

Education in Odisha is transforming through digital learning and innovative pedagogy, aiming to achieve inclusive and equitable quality education. This study examines the status, effectiveness, challenges, and strategies associated with digital integration in schools and higher education institutions throughout the state. Using a qualitative case study approach, data from teacher interviews, classroom observations, and policy analysis were examined to assess how technology and pedagogy intersect to improve learning outcomes. Findings reveal that initiatives such as the High School Transformation (HST 5T) program, ICT-enabled classrooms, and Shiksha Sanjog have strengthened digital infrastructure and enhanced student engagement, particularly in urban and semi-urban contexts. Pedagogical innovations, such as blended and flipped classrooms, foster greater motivation, participation, and achievement when aligned with frameworks like TPACK and SAMR.



However, challenges remain, especially in rural and marginalised areas, where poor internet connectivity, insufficient devices, limited teacher training, and socio-economic disparities restrict equitable access. The study emphasises that digital learning is most effective when embedded in constructivist, learner-centred approaches rather than as a mere substitution of traditional methods. It recommends capacity building through TPACK-based teacher training, expansion of blended learning, localised content development, community-driven innovations, and equity-focused policies, including device support schemes.

INTRODUCTION

Quality education is recognised globally as a cornerstone for sustainable development and social equity, as emphasised in the United Nations Sustainable Development Goal 4 (UNESCO, 2015). In India, the National Education Policy (NEP, 2020) envisions integrating technology and innovative pedagogy to transform learning experiences, enhance student engagement, and ensure inclusive education. Odisha, in particular, has initiated several reforms such as the High School Transformation (HST 5T) program, ICT-enabled classrooms, and community-based initiatives like Shiksha Sanjog, highlighting the state's commitment to educational modernisation (Government of Odisha, 2021).

Digital learning, when combined with innovative pedagogy, has the potential to transcend traditional rote-based methods and foster critical thinking, collaboration, and problem-solving skills (Mishra & Koehler, 2006; Puentedura, 2014). Frameworks such as TPACK emphasise the alignment of technology, pedagogy, and content. At the same time, the SAMR model illustrates how digital tools can progress from merely substituting traditional practices to a transformative redefinition of learning experiences. Similarly, constructivist approaches advocate active, learner-centred participation, aligning with blended and flipped classroom models that have shown positive impacts on student motivation and achievement (Garrison & Vaughan, 2008; Bishop & Verleger, 2013).

Despite these promising initiatives, challenges persist in Odisha, particularly in rural and marginalised contexts. Issues of unequal access to devices, poor internet connectivity, limited teacher preparedness, and socioeconomic disparities continue to hinder the full realisation of digital learning's potential (Sen, 1999). Addressing these barriers is essential to ensure that technological innovations contribute to equity rather than exacerbate divides.



Against this backdrop, the present study explores the status, effectiveness, challenges, and policy implications of digital learning and pedagogical innovations in Odisha. By situating the inquiry within theoretical frameworks and field realities, it seeks to provide evidence-based insights for advancing inclusive, equitable, and quality education in the state.

STATEMENT OF THE PROBLEM

“Beyond Access: Digital Learning, Pedagogical Change, and Inclusive Education in Odisha” explores how digital initiatives have expanded educational opportunities, yet disparities in access, teacher preparedness, and socioeconomic barriers persist. The study addresses the challenge of ensuring that technology-driven pedagogy truly fosters inclusive, equitable, and quality education across diverse contexts.

OBJECTIVES OF THE STUDY

1. To examine the current status and level of adoption and accessibility of digital learning tools across educational institutions in Odisha.
2. To analyse the effectiveness of digital pedagogical innovations in influencing students’ engagement, motivation, and academic achievement in Odisha.
3. To identify the institutional, infrastructural, and socio-economic barriers that hinder the effective use of digital learning and pedagogical innovations in Odisha.
4. To propose evidence-based strategies and policy measures to strengthen digital learning and pedagogical innovations for ensuring inclusive and equitable quality education in Odisha.

RESEARCH QUESTIONS

1. What is the present level of adoption and accessibility of digital learning tools across educational institutions in Odisha?
2. How do digital pedagogical innovations influence students’ engagement, motivation, and academic achievement in Odisha?
3. What institutional, infrastructural, and socio-economic barriers hinder the effective use of digital learning and pedagogical innovations in Odisha?
4. What evidence-based strategies can be proposed to strengthen digital learning and pedagogical innovations for ensuring inclusive and equitable quality education in Odisha?



REVIEW OF RELATED LITERATURE

Quality Education and Its Dimensions

Quality education is multidimensional, focusing on access, equity, inclusivity, and relevance to learner needs (UNESCO, 2015). It extends beyond literacy to develop cognitive skills, life competencies, and values for societal growth (Tikly & Barrett, 2011). India's NEP (2020) promotes competency-based learning, flexible curricula, and digital integration, while Odisha must reduce disparities and adopt context-specific pedagogy for better outcomes (Behera, 2021).

Digital Learning as a Catalyst

Digital learning, through platforms and tools, improves accessibility, flexibility, and personalised learning (Selwyn, 2016). Its importance grew during COVID-19 (World Bank, 2021). Initiatives like DIKSHA, SWAYAM, and Odisha's ICT programs show promise, but success depends on meaningful pedagogical integration (Das & Sahoo, 2020).

Pedagogical Innovations and Technology Integration

The TPACK framework (Mishra & Koehler, 2006) highlights that effective digital learning depends on balancing content knowledge, pedagogy, and technology. Blended learning, flipped classrooms, and inquiry-based approaches have been found to improve engagement and achievement (Garrison & Vaughan, 2008). In Odisha, experiments with blended and activity-based learning have shown positive impacts (Mohanty, 2020). Yet, inadequate teacher training, device scarcity, and linguistic diversity hinder equitable adoption (Jena, 2019).

Digital Equity and Inclusion in Odisha

The digital divide remains a critical concern. Unequal access to devices, the internet, and digital literacy may deepen inequalities (Warschauer, 2004). Odisha's rural-urban disparities reflect this challenge, with tribal areas facing infrastructural limitations (Pradhan & Behera, 2021; Patnaik, 2020). Nevertheless, localised digital content, vernacular e-resources, and community-driven mobile initiatives show promise for inclusive learning (Kumar, 2021).

THEORETICAL FRAMEWORK

1. Constructivist Learning Theory

The foundation of digital and innovative pedagogy rests on constructivism, which posits that learners actively construct knowledge through interaction with content, peers, and teachers (Piaget, 1973;



Vygotsky, 1978). Digital platforms such as interactive simulations, learning management systems, and collaborative tools align with this approach by enabling experiential, self-directed, and collaborative learning. In Odisha, initiatives like smart classrooms and WhatsApp-based Shiksha Sanjog groups embody constructivist principles, allowing learners to engage beyond traditional textbook-driven instruction.

2. Technological Pedagogical Content Knowledge (TPACK) Framework

The TPACK model by Mishra and Koehler (2006) emphasises the integration of technology, pedagogy, and content knowledge as essential for effective teaching. Teachers must not only master digital tools but also adapt pedagogical strategies to specific content. Odisha's blended learning training programs for teachers illustrate the operationalisation of this model, equipping educators to use digital platforms (e.g., Padlet, Flipgrid) meaningfully within curriculum contexts. TPACK thus provides a theoretical anchor for assessing teacher readiness and competence in digital pedagogy.

3. SAMR Model of Technology Integration

The Substitution, Augmentation, Modification, and Redefinition (SAMR) model (Puentedura, 2014) is helpful to evaluate how deeply technology transforms teaching and learning processes. In Odisha, digital interventions often begin at substitution (e.g., e-texts replacing print) or augmentation (e.g., WhatsApp worksheets). However, initiatives like AI curriculum integration aim for modification and redefinition by enabling new learning pathways, such as problem-solving through AI tools. The SAMR model thus helps identify the stages of technological integration in Odisha's schools and suggests pathways for deeper innovation.

4. Blended Learning and Flipped Classroom Models

Blended learning theory integrates face-to-face and online modalities to enhance flexibility and personalisation (Garrison & Vaughan, 2008). Similarly, the flipped classroom model reverses traditional lecture homework sequences, fostering active learning during class (Bishop & Verleger, 2013). Odisha's capacity-building programs that trained teachers in flipped learning and blended designs directly align with these frameworks. By providing both digital access and interactive pedagogy, these models can address disparities in rural and urban educational contexts.



5. Equity and Social Inclusion Lens

Amartya Sen’s Capability Approach (Sen, 1999) is relevant in the Odisha context, where digital and pedagogical innovations must ensure equitable access and inclusion. Socio-economic disparities and digital divides risk exacerbating inequalities if innovations are not inclusive. Therefore, quality education in Odisha requires not only technological innovation but also policies that expand learners’ real opportunities and capabilities. Programs like *CAMaL Ka Camp*, which combine playful pedagogy with low-cost approaches, exemplify such inclusive practices.

Methodology

Research Design: This study will employ a qualitative research design using a case study approach, as it provides in-depth insights into how digital learning and pedagogical innovations are shaping quality education in Odisha. The case study framework is suitable for understanding context-specific educational practices, teacher experiences, and systemic initiatives (Creswell, 2018).

Sampling

The study adopted purposive sampling to select research settings and participants relevant to digital learning practices in Odisha. The research was conducted in government schools. Special emphasis was placed on institutions implementing smart classrooms under the HST 5T programme. From the 5T secondary schools of Keonjhar district (Sadar Block), the sample included 25 teachers and 51 students at the secondary level, representing both rural and urban areas.

Data Collection Methods

Method	Participants/Source	Focus Area
Semi-structured Interviews	Teachers, students, and administrators	Perceptions, challenges, and outcomes of digital learning
Focus Group Discussions (FGDs)	Students and community members	Collective reflections on remote/hybrid learning and inclusive practices
Document Analysis	Policy documents (Odisha AI Policy 2025, NEP reports), training manuals, digital lesson	Policy priorities, institutional strategies, teacher training outcomes, and digital integration



	plans, and evaluation reports	practices
Observations	Smart classrooms, blended lessons, and community-based learning settings	Teacher–student interactions, use of digital tools, student engagement strategies

Data Analysis

The collected data analysed using thematic analysis (Braun & Clarke, 2006). The coding framework will be guided by:

- TPACK (to analyse teacher competence).
- SAMR (to assess levels of technology integration).
- Constructivism and Blended Learning theories (to evaluate pedagogy).
- Equity and Capability Approach (to assess inclusiveness and access).

NVivo software may be used for organising and coding qualitative data.

FINDINGS

The study explored the status, impact, barriers, and strategies of digital learning in Odisha.

RQ1: *What is the present level of adoption and accessibility of digital learning tools across educational institutions in Odisha?*

Odisha has made significant progress through initiatives like High School Transformation (HST 5T), introducing ICT labs, smart classrooms, and e-libraries. In urban and semi-urban areas, teachers and students frequently use projectors, e-content, and interactive boards. However, rural schools continue to struggle with poor connectivity, limited devices, and inadequate maintenance. While adoption is strong at the policy level, accessibility is uneven, with marginalized groups facing a pronounced digital divide.

RQ2: *How do digital pedagogical innovations influence students’ engagement, motivation, and academic achievement in Odisha?*

Findings revealed that digital pedagogy makes lessons more interactive and engaging, thereby enhancing



student motivation. Teachers employing blended and flipped models reported greater participation. Platforms like *Shiksha Sanjog* and AI-based content supported self-paced learning. Still, benefits were uneven, with students having smartphones and internet at home gaining more. Academic improvements were particularly evident where digital tools were integrated with learner-centered teaching strategies rather than used as textbook substitutes.

RQ3: *What institutional, infrastructural, and socio-economic barriers hinder the effective use of digital learning and pedagogical innovations in Odisha?*

Barriers were identified at multiple levels: (1) *Institutional*—insufficient teacher training and weak ICT monitoring; (2) *Infrastructural*—poor internet, equipment breakdowns, and inadequate devices; (3) *Socio-economic*—marginalized students lacking access to digital resources; (4) *Cultural*—parental perceptions of technology as a distraction.

RQ4: *What evidence-based strategies can be proposed to strengthen digital learning and pedagogical innovations for ensuring inclusive and equitable quality education in Odisha?*

Key strategies include: (1) Capacity Building through TPACK-based training; (2) Blended and Flipped Models for learner-centered teaching; (3) Community Engagement via low-cost tools such as WhatsApp and CAMaL Ka Camp; (4) Policy Integration aligning AI Policy 2025 with curricula; (5) Equity Measures like device distribution, subsidized internet, and local-language content.

DISCUSSIONS

Objective 1: Examining the Status and Integration of Digital Learning in Odisha

Odisha has made notable progress in digital infrastructure through initiatives such as HST 5T, which introduced smart classrooms, ICT labs, and digital libraries. Despite these advancements, significant disparities persist between urban and rural institutions. Using the SAMR model (Puentedura, 2014), most adoption is still at substitution and augmentation levels, where technology merely replaces or slightly enhances traditional methods. Deeper integration that redefines learning experiences remains limited. Constructivist theory (Vygotsky, 1978) emphasizes interactive, learner-centered practices, which are yet to be consistently realized, highlighting uneven pedagogical integration.

Objective 2: Analysing the Effectiveness of Pedagogical Innovations

Findings show that digital pedagogical approaches improved motivation, participation, and academic performance when combined with active learning methods. Blended learning (Garrison & Vaughan, 2008) and flipped classrooms (Bishop & Verleger, 2013) fostered autonomy and collaboration, while



schools applying the TPACK framework (Mishra & Koehler, 2006) achieved stronger outcomes by aligning technology with content and pedagogy. These results indicate that digital tools are most effective when teachers act as facilitators of constructivist learning, rather than as transmitters of information.

Objective 3: Identifying Challenges and Barriers

Barriers to digital learning emerged at institutional, infrastructural, and socio-economic levels. Insufficient teacher training, poor connectivity, equipment breakdowns, and limited devices hindered adoption. Additionally, marginalised students faced a digital divide due to a lack of access. In line with Sen's Capability Approach (1999), the study affirms that access alone does not ensure equity unless learners can meaningfully utilise resources. Without systemic reforms and TPACK-driven professional development, digital learning risks deepening existing inequalities.

Objective 4: Suggesting strategies and policy measures

The proposed strategies—capacity building, blended and flipped models, community innovations, AI curriculum integration, and equity schemes—align with international best practices. Moving adoption from substitution to redefinition (SAMR) can lead to transformative learning. Odisha's AI Policy 2025, if aligned with school curricula, can prepare learners for future-ready skills and position them as knowledge creators. Inclusive models such as CAMaL Ka Camp also ensure rural and marginalised learners are supported, reflecting Sen's equity perspective.

CONCLUSION

The study demonstrates that digital learning in Odisha has transformative potential but remains uneven due to infrastructural, institutional, and socio-economic barriers. While initiatives like HST 5T, Shiksha Sanjog, and the AI Policy 2025 have expanded resources, their effectiveness depends on teacher preparedness and inclusive strategies. Technology enhances outcomes most when embedded in learner-centered frameworks such as SAMR, TPACK, and blended learning. To avoid reinforcing divides, Odisha must strengthen capacity building, equitable access, and community-driven innovations. These steps can transform its education system into a more inclusive, innovative, and sustainable model for the future.

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