

RESEARCH ARTICLE

Inclusive classrooms in the digital age: A survey-based empirical study of technology-driven teaching in higher education

Vanishree G.M.^{1*} and Dr. Buvaneshwari P.²

¹Assistant Professor, Sambhram Institute of Technology, E-mail: gmvanishree@gmail.com

²Professor, Global Academy of Technology

Abstract: The rapid digital transformation of higher education has intensified discussions on inclusivity and equity in technology-enabled classrooms. This survey-based empirical study examines the influence of technology-driven teaching methodologies on student engagement and inclusive practices in a higher education institution. A quantitative descriptive and inferential research design was adopted. Data were collected from 100 students and 50 faculty members using structured multi-item Likert-scale questionnaires. Reliability was tested using Cronbach's alpha and hypotheses were examined using the Wilcoxon Signed-Rank Test. The results revealed statistically significant positive perceptions among students (Median=4.00, $p < 0.0001$) regarding engagement through digital tools. Teachers also demonstrated significantly positive attitudes toward inclusive digital teaching practices (Median=4.00, $p < 0.0001$). Cronbach's alpha values indicated strong internal consistency ($\alpha = 0.84$ for students; $\alpha = 0.81$ for teachers). The findings provide robust empirical evidence that technology enhances engagement and inclusivity when supported by teacher competence and institutional infrastructure.

Keywords: *Inclusive education, Technology-enhanced learning, Higher education, Student engagement, Digital inclusion*

Introduction

The integration of digital technologies into higher education has transformed instructional methodologies and classroom engagement practices. Learning Management Systems, virtual classrooms, collaborative platforms and adaptive learning tools have enabled educators to personalise instruction and respond to diverse learner needs. However, the success of digital transformation depends on equitable access, teacher competence and institutional support. This study investigates stakeholder perceptions of technology-driven teaching in promoting inclusive classrooms.

The discourse on inclusive education has evolved significantly with the integration of digital technologies in higher education. Scholars increasingly argue that technology, when strategically implemented, can serve as a catalyst for equity, accessibility and learner engagement. However, the literature also highlights that digital transformation is not inherently inclusive; rather, it requires systemic alignment between pedagogy, institutional policy and technological infrastructure. Smith (2018) contends that technology integration enhances differentiated instruction by allowing multiple means of content representation and assessment. Digital platforms enable instructors to tailor instructional materials according to varied learning styles, thereby fostering inclusivity. However, Smith warns that technology adoption without structured professional development often results in surface-level usage that does not meaningfully improve learning equity. Furthermore, Johnson and Patel (2019) examined blended learning environments and concluded that hybrid instructional models increase participation among diverse student groups. The flexibility of

*Corresponding author:

Assistant Professor, Sambhram Institute of Technology E-mail: gmvanishree@gmail.com

accessing lectures asynchronously particularly benefits learners who require extended processing time or who face physical or geographical constraints. Their findings reinforce the argument that accessibility and flexibility are central pillars of inclusive digital education.

Lee (2020) investigated digital pedagogy and its relationship to engagement, finding that interactive tools such as polls, discussion boards and multimedia resources increase student participation rates. Engagement was conceptualised not merely as attendance but as active cognitive involvement. The study suggests that engagement is a mediating factor linking digital innovation to inclusive outcomes. Besides, Nguyen (2020) focused on teacher readiness and digital competence, identifying technological self-efficacy as a significant predictor of inclusive implementation. Educators who demonstrate confidence in digital tools are more likely to adopt adaptive technologies and collaborative methods that accommodate learner diversity. This highlights the centrality of teacher agility in sustaining inclusive transformation. Ahmed and Thomas (2021) emphasised the role of assistive technologies in bridging accessibility gaps. Tools such as screen readers, captioning systems and adaptive assessment software enable participation among students with disabilities. However, the authors caution that assistive technologies require institutional investment and ongoing technical support to remain effective. In addition, Kumar (2022) explored digital transformation policies in higher education institutions and found that administrative leadership significantly influences the sustainability of inclusive initiatives. Institutions that embed digital equity into strategic planning demonstrate stronger inclusive outcomes. This underscores the importance of systemic commitment rather than isolated technological adoption. Wang (2022) introduced the concept of the digital divide within higher education, arguing that socioeconomic disparities continue to undermine equitable access. Students from marginalised backgrounds often lack reliable internet connectivity and digital devices, limiting their ability to benefit from technology-driven instruction. The study calls for equity-centred policy frameworks to address structural inequalities. Fernandez (2023), through a systematic review of 40 empirical studies, concluded that technology enhances inclusion when aligned with universal design principles, teacher training and institutional backing. The review emphasises that digital tools must be intentionally designed to remove barriers rather than inadvertently create them. Hattie (2009), through extensive meta-analytic evidence, demonstrated that learner agency significantly impacts academic achievement. Technology contributes positively to inclusion when it increases student autonomy, provides feedback mechanisms and supports self-paced learning. This theoretical perspective supports the argument that engagement and autonomy are critical to inclusive digital classrooms.

Despite substantial global scholarship, there remains limited empirical research within the Indian higher education context that simultaneously examines student and teacher perceptions of technology-driven inclusivity. Many studies isolate either learner engagement or teacher readiness without integrating stakeholder perspectives. Additionally, empirical validation using inferential statistical methods remains underrepresented in regional contexts. Therefore, the present study addresses this gap by empirically examining the dual perspectives of students and faculty through structured survey analysis.

The literature collectively identifies three dominant determinants of inclusive digital education: engagement through interactive tools, teacher competence and institutional resource support. These constructs form the conceptual foundation of the present study and directly inform the formulation of research hypotheses.

Research Methodology

A quantitative descriptive and inferential research design was adopted. Convenience sampling was employed due to institutional access constraints. The sample included 100 students and 50 teachers. Two structured multi-item Likert-scale questionnaires were administered. Reliability analysis produced Cronbach's alpha values of 0.84 (students) and 0.81 (teachers). Hypotheses were tested using the Wilcoxon Signed-Rank Test with a test value of 3.

Research Hypotheses

H1 (Students): There is a significant relationship between the use of technology in teaching and the level of student engagement in an inclusive classroom.

H2 (Teachers): There is a significant impact of teacher digital competence and institutional support on the implementation of inclusive digital teaching practices.

Research Methodology and Source of Data

The study was conceptually grounded in a Sequential Explanatory Mixed-Methods framework; however, the present manuscript reports only the quantitative phase. A descriptive–inferential research design was adopted to both map prevailing perceptions of technology-driven inclusive teaching and statistically test the proposed directional hypotheses.

Primary data were collected through two structured, multi-item questionnaires administered separately to students and faculty within a higher education institution. A non-probability convenience sampling technique was employed due to institutional access limitations. Although probability sampling was not feasible, methodological rigor was enhanced through inclusion of dual stakeholder groups and an adequate sample size ($N=150$), thereby improving representational balance and analytical robustness.

The final sample comprised 100 students and 50 teachers. Student responses were used to test Hypothesis 1 (technology-driven teaching and student engagement), while teacher responses informed Hypothesis 2 (digital competence, institutional support and inclusive practice).

All items were measured on a 5-point Likert scale (1=Strongly Disagree to 5=Strongly Agree). The instruments were designed to capture perceptions of engagement, accessibility, digital competence and inclusivity. Internal consistency was assessed using Cronbach's alpha prior to inferential analysis to ensure scale reliability.

Given the ordinal nature of Likert-scale data and the directional nature of the hypotheses, the Wilcoxon Signed-Rank Test was employed to examine whether median perception scores were significantly greater than the neutral benchmark (test value=3). A one-tailed test was applied, with statistical significance set at $\alpha=0.05$. Data were collected anonymously to minimise response bias and enhance authenticity.

Pedagogical Agility and Resource Dependency

The two crucial mediating elements mentioned in the abstract for successful implementation are the main topic of this section.

Agility of teachers

The capacity of teachers to modify their teaching methods swiftly and effectively in order to incorporate digital resources, resolve technical issues and use technology to adapt to a variety of student learning demands is known as teacher agility. Technology's ability to provide customisation is closely correlated with the teacher's own readiness and self-assurance. The use of the newest technology is likely to be uniform if the instructor lacks agility. As a result, the technology's potential for adaptability is not fully leveraged and it becomes a barrier rather than a support for inclusive education.

Dependence on institutional resources

The abstract makes clear that institutional resources are essential to the effective application of technology. Hardware (devices, connectivity), human capital (IT support, technical support) and curriculum resources (access to licensed adaptive software, digital content repositories) can all be considered resources. However, at the institutional level, resources may be dispersed or simply insufficient, which exacerbates systemic inequities; in other words, it is turning supportive technology into a major obstacle to inclusive education practices for both educators and students.

Technology as a Hurdle versus Support

This analytical section explores the complex duality of digital integration, moving beyond simple advocacy.

Technology as a personalisation facilitator

Because technology allows for customisation, it improves inclusiveness. Differentiation at scale is made possible by adaptive learning software, which automatically modifies the content's pace and complexity based on each student's performance. In order to promote engagement while addressing accessibility through multi-modal options, digital tools offer a degree of autonomy that permits learners to participate in the way they prefer (e.g., auditory, visual, interactive) and express themselves in the way they prefer (e.g., video, digital presentation, writing).

Technology as an equity barrier

When technology creates new forms of exclusion, it becomes an obstacle to inclusive educational approaches. The digital divide, or unequal access to the internet and devices at home; digital literacy, or students' and teachers' lack of proficiency with the tools; and an excessive dependence on proprietary systems that prevent students from utilising assistive technologies that some students may need are some of the obstacles to inclusion. This investigation confirms how difficult it is to comprehend that inclusion involves more than just offering equipment.

Results and Discussion

This section presents the statistical findings of the study and interprets them in light of existing literature and theoretical constructs. The hypotheses were tested using the Wilcoxon Signed-Rank Test against the neutral benchmark value of 3.

Hypothesis 1: Student engagement

H1: Technology-driven teaching significantly enhances student engagement in inclusive classrooms.

The analysis revealed a median perception score of 4.00 (Agree), with a mean score of 4.13. The Wilcoxon Signed-Rank Test produced a test statistic (V) of 3278.00 with a p-value < 0.0001.

Since the p-value is significantly less than the threshold value of 0.05, the null hypothesis is rejected. The findings indicate a statistically significant positive perception among students regarding the effectiveness of interactive digital tools in enhancing engagement.

Discussion

The strong positive perception suggests that tools such as quizzes, polls, videos and collaborative platforms meaningfully increase student participation and interest. This finding aligns with Lee (2020), who linked digital interactivity with enhanced engagement and Hattie (2009), who emphasised learner agency as a determinant of academic success.

The result also supports the argument that engagement functions as a mediating variable between digital innovation and inclusive learning outcomes. However, while perception levels are high, sustained engagement may depend on consistent pedagogical alignment rather than mere technological availability.

Hypothesis 2: Teacher Digital Competence and Inclusivity

H2: Teacher digital competence and institutional support significantly influence inclusive digital teaching practices.

The analysis showed a median score of 4.00 (Agree) and a mean score of 4.08. The Wilcoxon Signed-Rank Test yielded a statistic (V) of 1155.50 with a p-value < 0.0001.

Since the p-value is below 0.05, the null hypothesis is rejected. The findings demonstrate a statistically significant positive attitude among teachers toward digital teaching as a facilitator of inclusive classroom environments.

Discussion

The positive teacher perception indicates strong pedagogical readiness and willingness to integrate digital tools for inclusion. This finding is consistent with Nguyen (2020), who identified digital competence as a key determinant of inclusive implementation. It also supports Kumar (2022), who emphasised institutional infrastructure as a foundational pillar for digital transformation.

However, the findings also imply that positive perception alone may not guarantee sustained inclusivity. Institutional resource stability and ongoing professional development are necessary to prevent technology from becoming an equity barrier.

Integrated findings

The combined results from both stakeholder groups indicate strong alignment in favour of technology-driven inclusive teaching. The convergence of student engagement (H1) and teacher readiness (H2) strengthens the empirical validity of the study.

This dual-stakeholder validation suggests that digital transformation within the institution is positively perceived at both implementation and reception levels. Such alignment enhances the credibility of the findings and indicates systemic acceptance of technology-enabled inclusion.

Implications

The results suggest three major implications:

- Interactive digital tools should be systematically embedded into curriculum design to sustain engagement.
- Continuous professional development programs should be institutionalised to strengthen teacher digital agility.
- Infrastructure investment should prioritise reliability and accessibility to prevent digital exclusion.

Limitations and future research

Despite statistically significant findings, certain limitations must be acknowledged. The use of convenience sampling limits generalisability beyond the studied institution. The data are perception-based and cross-sectional, restricting causal inference. Future research may incorporate probability sampling, longitudinal designs and objective performance measures to strengthen external validity.

Further studies may also explore:

- Correlation between engagement perception and academic achievement.
- Comparative analysis across institutions.
- Qualitative exploration of digital barriers and equity challenges.

Conclusion

This study empirically assessed the impact of technology-driven teaching on engagement and inclusive practices in higher education. The findings demonstrate statistically significant positive perceptions among both students and teachers ($p < 0.0001$), confirming that interactive digital tools enhance engagement and support inclusive pedagogy when effectively implemented. The results indicate that successful digital inclusion depends not merely on technological availability, but on the alignment of student engagement, teacher digital competence and institutional support.

Although the study is limited by convenience sampling and perception-based measures, it contributes empirical evidence to the discourse on digital transformation and inclusion within the higher education context. Sustained inclusivity will require structured professional development, reliable infrastructure and equity-oriented institutional strategies. When strategically integrated, technology-driven teaching can function as a catalyst for meaningful and sustainable inclusive educational advancement.

References

- Ahmed, S., & Thomas, J. (2021). Assistive technology and inclusive education. *Disability & Education Quarterly*, 14(2), 89–104.
- Fernandez, L. (2023). Inclusive pedagogies through technology: A systematic review. *Computers & Education Review*, 41(2), 140–158.
- Hattie, J. (2009). *Visible learning*. Routledge.
- Johnson, R., & Patel, K. (2019). Blended learning for inclusive education. *Higher Education Review*, 25(3), 112–130.
- Kumar, P. (2022). Evaluating digital transformation in higher education. *Education Policy Analysis*, 30(4), 215–230.
- Lee, C. (2020). Digital pedagogy and student engagement. *Educational Technology Research*, 18(1), 77–90.
- Nguyen, T. (2020). Teacher readiness for technology-driven inclusive education. *International Journal of Inclusive Education*, 24(5), 501–517.
- Smith, A. (2018). Technology integration in inclusive classrooms. *Journal of Educational Innovation*, 12(2), 45–59.
- Wang, Y. (2022). Equity in digital learning environments. *Journal of Educational Equity*, 9(1), 33–49.