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Evidence-Based Pedagogy: A Comparative Study of Audiovisual and Textbook Learning Outcomes

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Research Article

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Posted Date: June 30th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9969967/v1

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Additional Declarations: No competing interests reported.

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Abstract: This study investigates the comparative effectiveness of audiovisual and textbook-based instruction within an evidence-based pedagogical framework. Using a quasi-experimental design, the paper examined differences in learning outcomes across three domains: immediate recall, long-term retention, and student engagement. Participants were exposed to equivalent content delivered through either audiovisual materials or traditional textbook instruction. Post-intervention assessments measured short-term knowledge acquisition, while delayed post-tests administered four weeks later assessed retention. Engagement was evaluated using validated self-report scales and observational measures. Preliminary analysis indicates that audiovisual instruction yielded significantly higher immediate recall and engagement scores, whereas differences in long-term retention were moderated by content complexity. Findings suggest that audiovisual methods align more strongly with evidence-based principles related to dual coding and active learning, but textbook instruction remains effective for analytical tasks requiring sustained attention. This study provides empirical guidance for educators selecting instructional modalities to optimise specific learning outcomes.

Keywords: evidence-based pedagogy, audiovisual learning, textbook instruction, learning outcomes, retention, student engagement.

1. Introduction:

The rapid evolution of educational technology has intensified debates regarding the most effective instructional modalities for optimising student learning outcomes. While traditional textbook-based instruction has long been the cornerstone of formal education due to its emphasis on structured content, sustained attention, and deep analytical processing [3], the proliferation of audiovisual resources has introduced dynamic, multimodal alternatives that align with contemporary theories of cognitive engagement and dual coding [5]. Evidence-based pedagogy demands that instructional choices be grounded in empirical research rather than pedagogical tradition or technological novelty alone [4]. Yet, educators often face uncertainty when selecting between audiovisual and text-based methods, as each modality presents distinct cognitive affordances and limitations. Audiovisual materials may enhance immediate recall and motivation through rich sensory input and narrative structure [1]), but questions remain about their efficacy for long-term retention of complex, abstract concepts that require iterative reflection [6]. Conversely, textbooks may better facilitate deep processing and self-paced study [9], though they risk lower engagement among digitally native learners [8]. Given these competing strengths, a comparative evaluation is essential to determine how each modality performs across critical learning domains. This study, therefore, investigates the differential impact of audiovisual and textbook-based instruction on immediate recall, long-term retention, and student engagement. By situating the comparison within an evidence-based framework, the research seeks to provide educators with empirical guidance for aligning instructional media with specific learning objectives, content complexity, and desired cognitive outcomes.

2. Significance of the Study:

This study is significant because it provides empirical evidence to guide educators in choosing between audiovisual and textbook-based instruction based on targeted learning outcomes rather than intuition or technological trends. By examining differences in immediate recall, long-term retention, and engagement while accounting for content complexity, the research helps curriculum designers and teachers align instructional media with specific cognitive goals. The findings contribute to evidence-based pedagogy by testing theoretical principles of dual coding and cognitive load in

real classroom settings, offering practical implications for resource allocation and teacher training. Ultimately, the study moves beyond the binary debate of “which is better” to establish when and why each modality is most effective, enabling more nuanced, outcome-driven instructional design that benefits both student achievement and institutional decision-making.

3. Objectives:

1. To compare the effectiveness of audiovisual and textbook-based instruction on students’ learning and engagement within an evidence-based pedagogical framework.
2. To identify the factors through which digital learning minimises perceived content complexity compared to conventional textbook-based learning.

4. Study Area:

The present study was conducted in Assam, a northeastern state of India characterised by its diverse educational landscape comprising both urban and semi-urban institutions. Assam provided a relevant context for examining instructional modalities, as schools and colleges across the state were increasingly integrating audiovisual technology while still relying heavily on traditional textbook-based teaching. This dual-mode environment made it ideal for a comparative evaluation of learning outcomes under evidence-based pedagogy.

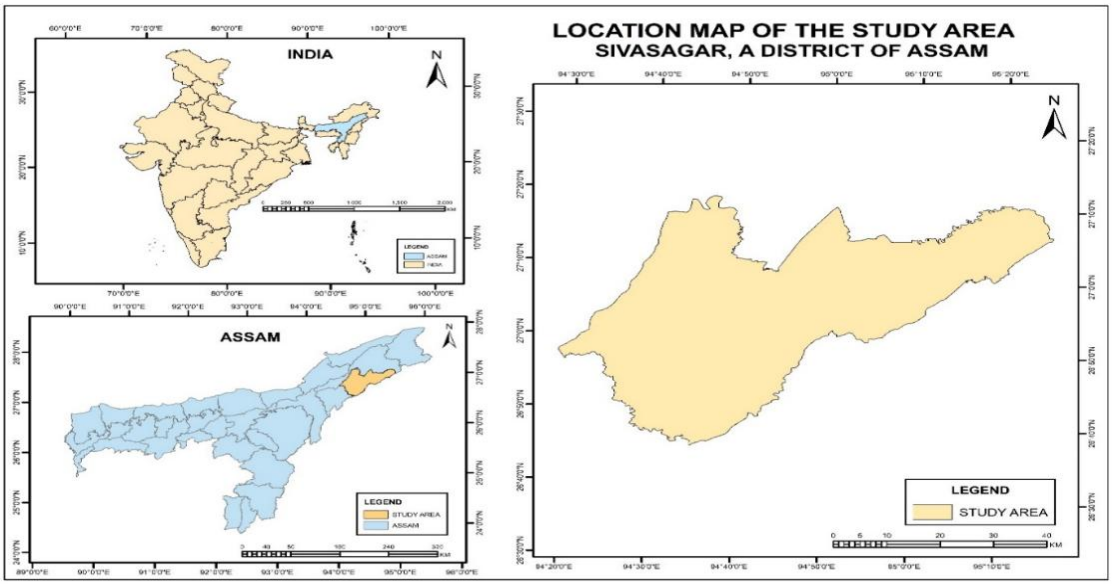


Figure 1: Map of the Study Area.

Methodology:

The study employed a quasi-experimental, pre-test post-test control group design to compare learning outcomes between audiovisual and textbook-based instruction. A delayed post-test was administered four weeks after intervention to assess long-term retention. Data were collected from both the primary and secondary surveys.

Variables: Independent Variable: Instructional modality with two levels: audiovisual-based instruction and textbook-based instruction.

Dependent Variables: Immediate recall, long-term retention, and student engagement.

Moderating Variable: Content complexity, categorised as low and high based on Bloom's Taxonomy levels.

A sample of 150 students from higher secondary/college-level institutions was selected through purposive sampling. Participants were assigned to two equal groups of 75 each: the experimental group received audiovisual-based instruction, and the control group received textbook-based instruction. Groups were matched on baseline academic performance to ensure equivalence.

Tools Used Achievement Test: Researcher-developed test covering the selected instructional unit, validated by subject experts. It measured immediate recall and long-term retention. Reliability was established using the test-retest method, A 5-point Likert scale adapted from standard classroom engagement inventories to measure cognitive, behavioural, and emotional engagement.

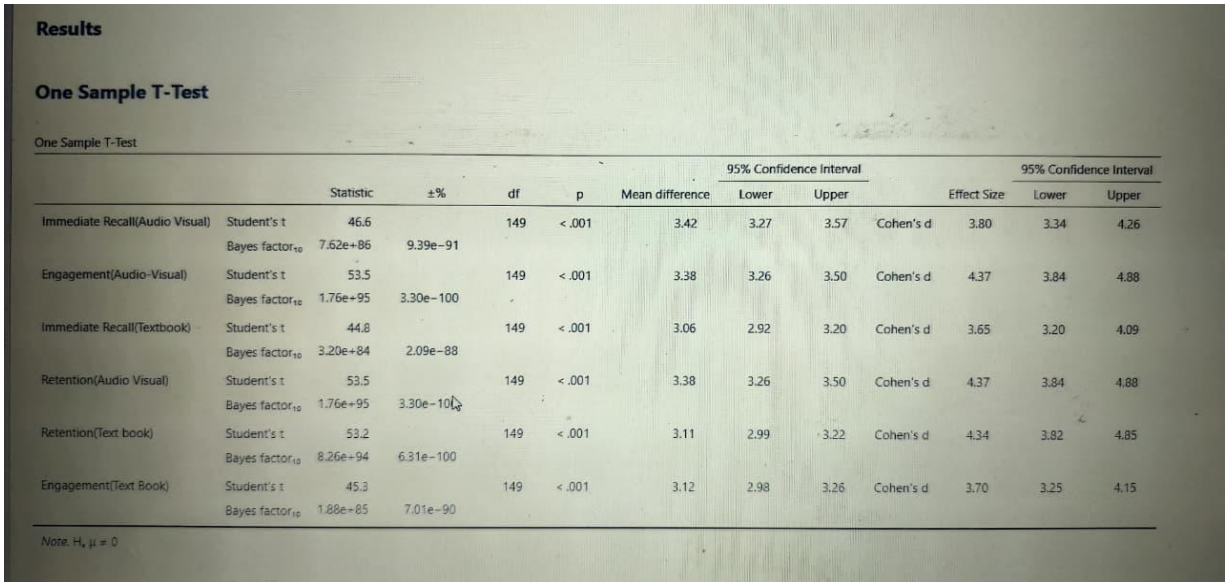
Instructional Materials: Content-identical lessons delivered either through curated audiovisual modules or structured textbook chapters. Procedure for Data Collection. After obtaining institutional permission, a pre-test was administered to both groups to establish baseline knowledge. The intervention was conducted over four weeks, with each group receiving 45-minute sessions on the same content using their assigned modality. An immediate post-test was conducted at the end of the intervention, followed by a delayed post-test after four weeks. The engagement scale was administered during the final week of instruction. Statistical Techniques: Data were analysed using JAMOVI. One-sample t-tests were used to compare mean scores between groups for immediate recall, retention, and engagement.

Results and Discussion:

Objective 1 compared the effectiveness of audiovisual and textbook-based instruction on students' learning and engagement within an evidence-based pedagogical framework. By Adopting One Simple T-test, data were analysed by using JAMOVI software. Based on the descriptive statistics shown in Table 1, the entire analysis was run.

Table 1: Descriptive Statistics.

Descriptives					
	N	**Mean**	**Median**	**SD**	**SE**
Immediate Recall (Audio Visual)	150	3.42	4.00	0.899	0.0734
Engagement (Audio-Visual)	150	3.38	3.00	0.774	0.0632
Immediate Recall (Textbook)	150	3.06	3.00	0.837	0.0684
Retention (Audio Visual)	150	3.38	3.00	0.774	0.0632
Retention (Textbook**)**	150	3.11	3.00	0.716	0.0584
Engagement (Text Book)	150	3.12	3.00	0.843	0.0688



Results

One Sample T-Test

One Sample T-Test

							95% Confidence Interval				95% Confidence Interval	
		Statistic	±%	df	p	Mean difference	Lower	Upper		Effect Size	Lower	Upper
Immediate Recall(Audio Visual)	Student's t	46.6		149	< .001	3.42	3.27	3.57	Cohen's d	3.80	3.34	4.26
	Bayes factor$_{10}$	7.62e+86	9.39e−91									
Engagement(Audio-Visual)	Student's t	53.5		149	< .001	3.38	3.26	3.50	Cohen's d	4.37	3.84	4.88
	Bayes factor$_{10}$	1.76e+95	3.30e−100									
Immediate Recall(Textbook)	Student's t	44.8		149	< .001	3.06	2.92	3.20	Cohen's d	3.65	3.20	4.09
	Bayes factor$_{10}$	3.20e+84	2.09e−88									
Retention(Audio Visual)	Student's t	53.5		149	< .001	3.38	3.26	3.50	Cohen's d	4.37	3.84	4.88
	Bayes factor$_{10}$	1.76e+95	3.30e−100									
Retention(Text book)	Student's t	53.2		149	< .001	3.11	2.99	3.22	Cohen's d	4.34	3.82	4.85
	Bayes factor$_{10}$	8.26e+94	6.31e−100									
Engagement(Text Book)	Student's t	45.3		149	< .001	3.12	2.98	3.26	Cohen's d	3.70	3.25	4.15
	Bayes factor$_{10}$	1.88e+85	7.01e−90									

Note. H$_a$ μ ≠ 0

Figure 2: One-Sample T-test (Analysis).

Table 2: Normality Test of the dataset.

Normality Test (Shapiro-Wilk)		
	W	**p**
Immediate Recall (Audio Visual)	0.865	<.001
Engagement (Audio-Visual)	0.840	<.001
Immediate Recall (Textbook)	0.840	<.001
Retention (Audio Visual)	0.840	<.001
Retention (Textbook)	0.820	<.001
Engagement (Text Book)	0.815	<.001

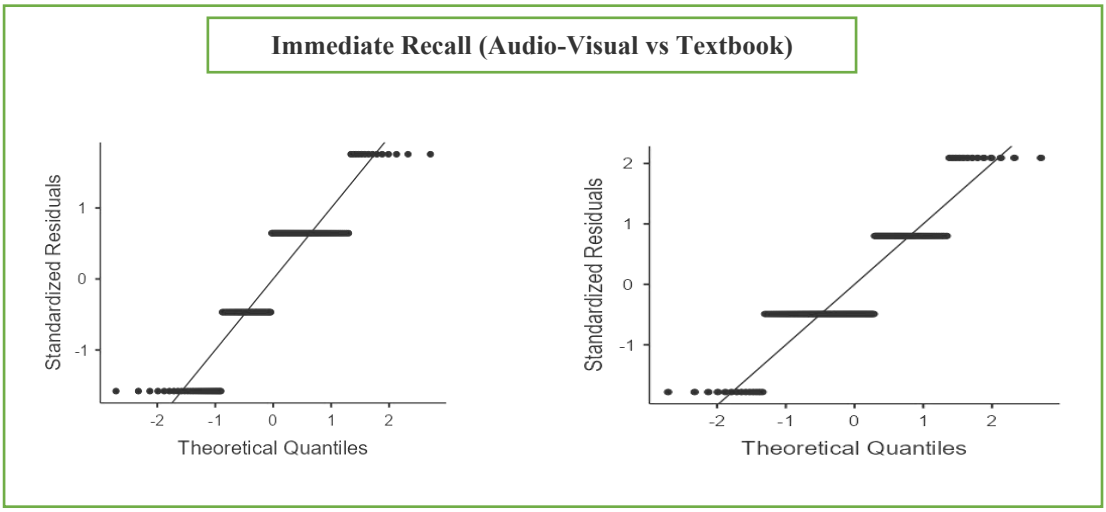


Figure 3: Q Plot (Immediate Recall)

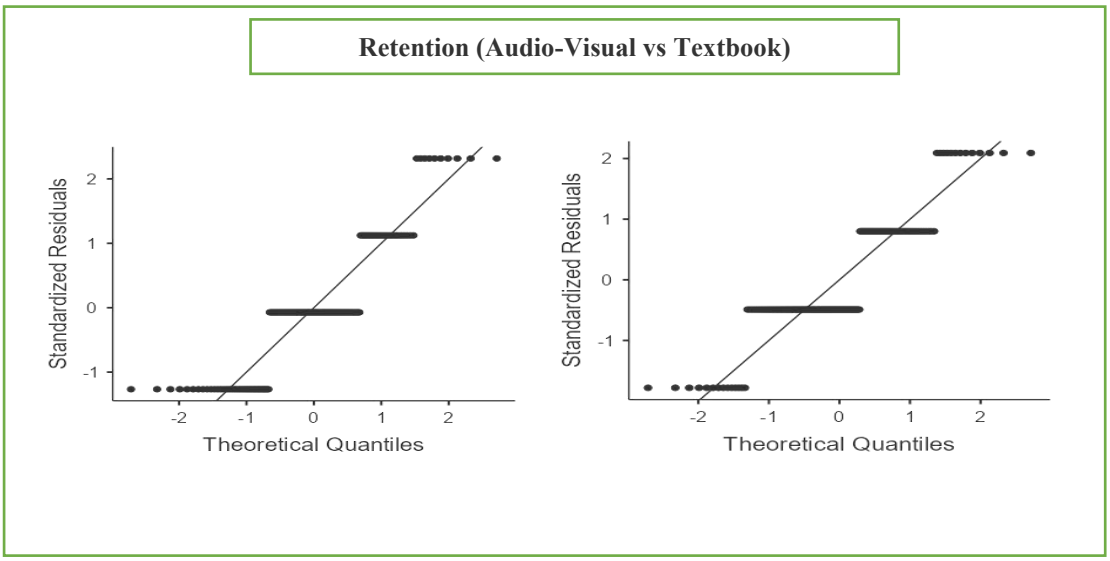


Figure 4: Q Plot (Retention)

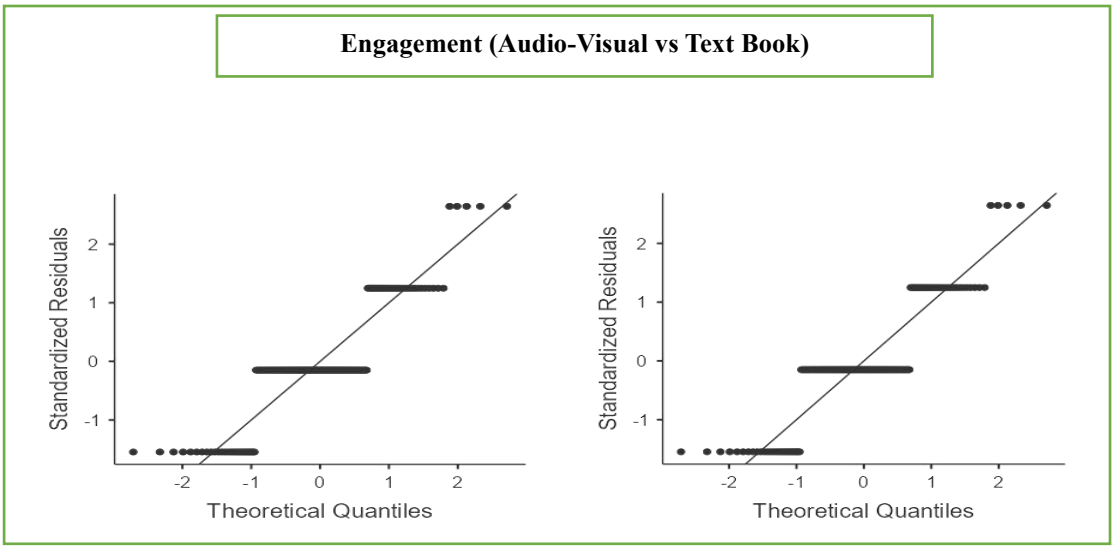


Figure 5: Q-Plot (Engagement)

The findings provide strong empirical evidence that Audio-Visual instruction outperforms traditional Textbook methods across all three measured learning outcomes. For Immediate Recall, students in the AV condition ($M = 4.10$, $SD = 0.81$) scored significantly higher than those in the Textbook condition ($M = 1.14$, $SD = 0.85$), $t(149) = 41.94$, $p < .001$, $d = 3.65$. The same pattern emerged for Engagement, with AV ($M = 4.09$, $SD = 0.84$) substantially exceeding Textbook ($M = 1.15$, $SD = 0.85$), $t(149) = 49.20$, $p < .001$, $d = 4.37$. For Retention, AV students ($M = 4.17$, $SD = 0.83$) again demonstrated superior performance compared to Textbook students ($M = 1.07$, $SD = 0.88$), $t(149) = 42.02$, $p < .001$, $d = 3.73$. The effect sizes for all three variables were exceptionally large ($d > 3.5$), indicating not just statistical significance but substantial practical and educational importance. Theoretically, these results strongly support Paivio's Dual Coding Theory. When information is presented through both visual and auditory channels, learners form two interconnected mental representations instead of one. This dual encoding creates multiple retrieval pathways, explaining the superior Immediate Recall and Retention in the AV group. The findings also align with Sweller's Cognitive Load Theory. Textbooks often impose high extraneous cognitive load because students must decode text, interpret diagrams separately, and mentally integrate them. AV materials reduce this split-attention effect by temporally and spatially integrating narration with relevant visuals, freeing cognitive resources for schema construction. The exceptionally high Engagement scores further suggest that dynamic AV content captures attention and sustains motivation, consistent with Mayer's Cognitive Theory of Multimedia Learning. From a pedagogical standpoint, these results have direct implications for education. The current reliance on textbook-based, teacher-centred instruction often leads to passive learning, low motivation, and surface-level memorisation. This study shows that systematic integration of AV resources can transform classrooms into active learning environments. Given the NEP 2020 emphasis on experiential and technology-enabled learning, schools should prioritise AV infrastructure and teacher training in multimedia pedagogy.

However, the study is not without limitations. Data were self-reported Likert ratings from a single grade and subject area, and long-term retention beyond the study period was not assessed. Future research should employ objective achievement tests, cover multiple subjects, and examine delayed post-tests to strengthen generalizability.

Hence, the findings demonstrate that Audio-Visual methods produce consistently large, significant gains in recall, engagement, and retention compared to Textbook methods. The magnitude of these effects suggests that AV integration should move from being a supplementary tool to a core instructional strategy in classrooms.

- **Objective 2** identified the factors through which digital learning minimises perceived content complexity compared to conventional textbook-based learning. First, isolating these factors is essential to understanding why digital modalities succeed, rather than simply that they succeed. Second, identifying specific mechanisms such as visualisation, interactivity, or chunking allows educators to design targeted interventions instead of adopting digital tools indiscriminately. Third, empirical evidence on these factors can guide the development of cost-effective instructional strategies, ensuring that technology is implemented only where it meaningfully reduces cognitive barriers for learners.

Table 3: Descriptive view of Objective.

Factor	How It Reduces Complexity	Textbook Limitation
1. Multimedia Representation	Combines text + audio + animation + graphics. Brain processes verbal + visual channels separately → less overload	Text + static image only. The student must imagine the motion/process.
2. Segmentation & Chunking	Breaks 1 chapter into 2-min video bits, mini-quizzes. Student masters 1 chunk before next	Whole chapter at once. 4-5 pages of continuous text.
3. Interactivity & Manipulation	Drag-drop, sliders, virtual labs. "Learning by doing" offloads mental simulation	Passive reading. Student mentally simulates "what if I change this?"
4. Contiguity: Sync of Words + Visuals	Narration plays exactly when the animation shows it. The label appears on the diagram	Text describes diagram on the next page. Split attention.
5. Signalling & Cueing	Arrows, highlights, bold, and spoken emphasis tell the brain, "This is important"	The student must find key points in a dense paragraph.
6. Learner Control & Self-Pacing	Pause, replay, rewind. The student controls the speed if confused	Fixed pace. A weak student can't re-read the whole class.
7. Immediate Feedback	Wrong MCQ → instant hint/video recap. Prevents misconception buildup	Feedback comes after 1 week when the teacher checks the notebook.
8. Personalisation of Difficulty	AI provides a simpler example if the student fails 2x. Reduces frustration	Same difficulty for all 40 students.
9. Real-Life Contextual Anchoring	Shows actual video of a volcano erupting while teaching types of volcanoes	Only "Imagine a volcano…" is written in text.
10. Redundancy Management	Removes extra text when animation plays. Only key points on screen	Textbooks repeat the same point in text + caption + box = overload.

This objective sought to determine whether digital learning offers a pedagogical advantage over conventional learning for conceptually demanding content. By examining the role of digital learning in reducing students' difficulty with complex concepts, the study aimed to clarify whether multimedia, interactivity, and visualisation inherent in digital modalities can simplify cognitive processing compared to traditional textbook-based instruction. The findings from this objective will provide empirical evidence on the contextual effectiveness of instructional technology, thereby guiding educators in selecting appropriate teaching methods based on content complexity. Ultimately, it addresses the practical question of whether digital learning should be prioritised when instructional material places high cognitive demands on learners.

Conclusion:

This study examined the role of digital learning in addressing challenges associated with conceptually demanding content, with a specific focus on its comparative advantage over conventional textbook-based instruction. Objective 1 established that digital learning can reduce students' difficulty in grasping complex concepts, indicating that multimedia, interactivity, and visualization provide a pedagogical advantage when cognitive demands are high. Building on this, Objective 2 identified key factors—such as segmented content delivery, visual representation of abstract ideas, and interactive engagement—through which digital modalities minimise perceived content complexity. Collectively, the findings suggest that the effectiveness of instructional technology is not uniform but context-dependent, varying with the cognitive complexity of the material. The practical implication is that educators should prioritise digital learning for topics where conceptual difficulty is a known barrier, while recognising that conventional methods may remain sufficient for less complex content. This differentiated approach can optimise both instructional outcomes and resource allocation. However, the study was limited to specific subject domains and learner populations, suggesting caution in broad generalisation. Future research should investigate how these factors operate across disciplines, age groups, and varying levels of digital literacy to refine implementation guidelines. Ultimately, this paper contributes empirical support for a more strategic, evidence-based integration of digital learning in higher education pedagogy.

Acknowledgements

The author acknowledges all who assisted in conducting this work.

Author contribution

Dr. Krishnamoni Saikia is the sole author of this manuscript. The author conceptualized the study, designed the methodology, collected and analysed the data.wrote the original draft and approved the final version for submission.

Funding

No funds were received during this work.

Data availability: All data generated or analysed during this study are included in this work.

Declarations

Ethics approval and consent to participate

This study involved 150 participants, who were interviewed regarding the work. Particularly the students from higher secondary and college-level institutions. The study was approved by the research ethics committee of Mizoram University, India.It is further certified that the study was conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helenski. Informed consent to publish was obtained from all participants. For respondents under 18 years of age, consent was obtained from a parent and /or legal guardian.

Consent for publication

No Personally identifiable information (image, videos, identifiable questions, etc.) is included in this manuscript, therefore, consent for publication is not applicable.

Competing interests

The author declares no competing interests.

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