



INSTRUCTIONAL DESIGN AND TEACHER AGENCY IN TECHNOLOGY-ENHANCED HYBRID LEARNING

Noor Aziz¹, Pieter Hendriks², and Eva Janssen³

¹ Universitas Sains Al Qur'an Jawa Tengah, Indonesia

² Utrecht University, Netherlands

³ Leiden University, Netherlands

Corresponding Author:

Noor Aziz,

Department of Islamic education, Faculty of Education and Teacher Training, UNSIQ

MWF7+JJ6, Rw. 7, Andongsili, Kec. Mojotengah, Kabupaten Wonosobo, Jawa Tengah 56351

Email: nooraziz@unsiq.ac.id

Article Info

Received: October 8, 2025

Revised: January 13, 2026

Accepted: March 20, 2026

OnlineVersion: April 29, 2026

Abstract

Technology-enhanced hybrid learning has transformed contemporary education by integrating digital platforms with face-to-face instruction, yet it raises persistent challenges regarding instructional design coherence and teacher agency in pedagogical decision-making. This study aims to examine the relationship between instructional design and teacher agency in hybrid learning environments and to explore how their interaction influences teaching effectiveness. A qualitative research design based on systematic literature review and interpretive analysis was employed, drawing on peer-reviewed studies, institutional reports, and educational technology frameworks published between 2015 and 2026. Findings reveal that instructional design provides structural guidance for hybrid learning implementation, while teacher agency enables adaptive, context-responsive pedagogical practices. The results further indicate that effective hybrid learning emerges from a dynamic balance between standardized instructional frameworks and teacher autonomy in utilizing digital technologies. Institutional support, technological infrastructure, and professional development significantly influence this balance. The study concludes that instructional design and teacher agency are interdependent constructs that jointly determine the success of technology-enhanced hybrid learning systems, highlighting the need for flexible pedagogical frameworks that empower teachers as active designers of learning.

Keywords: Adaptive Learning Design, Hybrid Education Systems, Instructional Design, Teacher Agency, Technology Integration



© 2026 by the author(s)

This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution-ShareAlike 4.0 International (CC BY SA) license (<https://creativecommons.org/licenses/by-sa/4.0/>).

Journal Homepage

<https://research.adra.ac.id/index.php/jnhl>

ISSN: (P: 2987-2316) - (E: 2986-979X)

How to cite:

Aziz, N., Hendriks, P., & Janssen, E. (2026). Instructional Design and Teacher Agency in Technology-Enhanced Hybrid Learning. *Journal Neosantara Hybrid Learning*, 4(2), 135–148. <https://doi.org/10.70177/jnhl.v4i2.4052>

Published by:

Yayasan Adra Karima Hubbi

INTRODUCTION

Global education systems have undergone significant transformation due to rapid advancements in digital technology, shifting pedagogical paradigms, and increased demand for flexible learning environments (Imran & Li, 2025). Hybrid learning, which combines face-to-face instruction with technology-mediated learning, has emerged as a dominant instructional model across higher education and school systems worldwide (Wong, 2026). This model aims to enhance accessibility, flexibility, and learner engagement while maintaining instructional quality and pedagogical effectiveness (Kozlova & Nowlan, 2026). Integration of educational technologies such as learning management systems, artificial intelligence tools, and interactive digital platforms has fundamentally reshaped how teaching and learning processes are designed and implemented in contemporary educational contexts.

Instructional design plays a critical role in ensuring that hybrid learning environments are pedagogically sound, structured, and aligned with learning outcomes (Jew & Blumberg, 2025). Effective instructional design requires careful planning of content sequencing, learning activities, assessment strategies, and technology integration (Makori et al., 2025). However, the increasing complexity of hybrid learning environments has introduced new challenges for educators in balancing technological tools with pedagogical intentions (Er, 2024). Teachers are expected to design learning experiences that are both engaging and academically rigorous while simultaneously managing diverse learner needs in digital and physical spaces.

Teacher agency has become an essential concept in understanding how educators navigate instructional decisions within technology-enhanced learning environments (Garay Abad & Hattie, 2025). Teacher agency refers to the capacity of educators to make intentional pedagogical choices, adapt instructional strategies, and exercise professional autonomy in response to contextual demands (Banihashem et al., 2025). In hybrid learning settings, teacher agency is increasingly shaped by technological infrastructures, institutional policies, and curriculum constraints (McNaughton et al., 2024). The interaction between instructional design and teacher agency determines the effectiveness of hybrid learning implementation and its impact on student learning outcomes.

Hybrid learning environments often present tensions between standardized instructional design frameworks and the need for adaptive teaching practices (Lin & Tan, 2025). Many instructional models emphasize structured digital content delivery, which may limit teacher autonomy in customizing learning experiences (Alajlani & Crabb, 2025). This creates challenges in aligning institutional expectations with classroom-level pedagogical decision-making.

Teachers frequently encounter difficulties in integrating digital tools into instructional design in ways that meaningfully enhance learning rather than simply digitizing traditional practices (Noroozi et al., 2025). Lack of clear guidance on balancing pedagogical goals with technological affordances contributes to inconsistent implementation of hybrid learning models (Jeon et al., 2024). These challenges may reduce instructional effectiveness and limit student engagement.

Insufficient understanding of the dynamic relationship between instructional design and teacher agency in hybrid learning contexts represents a significant problem in contemporary educational research (Brummernhenrich et al., 2025). Existing frameworks often treat instructional design and teacher agency as separate constructs, resulting in fragmented approaches to studying technology-enhanced education (Zhang et al., 2024). This separation limits comprehensive understanding of how teachers actively shape hybrid learning environments.

This study aims to examine the relationship between instructional design practices and teacher agency within technology-enhanced hybrid learning environments (Faisal et al., 2025). The focus is directed toward understanding how educators design, adapt, and implement instructional strategies in response to technological and pedagogical demands.

The research seeks to identify key factors that influence teacher agency in hybrid learning contexts, including institutional support, digital competency, curriculum structure, and technological infrastructure (Baidoo-Anu et al., 2024). Analysis of these factors provides insight into conditions that enable or constrain effective instructional decision-making.

The study further aims to develop a conceptual understanding of how instructional design frameworks can be aligned with teacher agency to improve hybrid learning effectiveness (Shigli et al., 2025). Findings are expected to contribute to the development of more flexible, adaptive, and teacher-centered instructional design models.

Existing literature on instructional design in digital education primarily focuses on technological integration, curriculum alignment, and learning outcome optimization (Saseendran et al., 2025). While these studies provide valuable insights into structured learning design, they often underemphasize the role of teacher agency in shaping instructional processes within hybrid environments.

Research on teacher agency has traditionally been situated within sociocultural and professional identity frameworks, with limited attention to its interaction with instructional design models in technology-rich settings (Zhou et al., 2025). This creates a conceptual gap between pedagogical design theories and teacher-centered decision-making processes.

Few studies have systematically examined the intersection between instructional design and teacher agency in hybrid learning environments (Zhan et al., 2024). The absence of integrated frameworks limits understanding of how educators negotiate between technological constraints and pedagogical autonomy, particularly in blended and digitally enhanced instructional settings.

This study introduces a novel integrative perspective by conceptualizing instructional design and teacher agency as interconnected components of hybrid learning systems (Krishnaveni et al., 2025). Unlike previous research that treats these constructs separately, this study emphasizes their dynamic interaction in shaping effective technology-enhanced education.

The research contributes to educational theory by proposing a conceptual framework that aligns instructional design principles with teacher agency within hybrid learning environments (Murariu et al., 2025). This framework highlights the role of teachers as active designers rather than passive implementers of instructional technologies.

The significance of this study lies in its potential to inform policy, curriculum development, and teacher professional development programs (Khoiruddin et al., 2025). By emphasizing the synergy between instructional design and teacher agency, the study supports the development of more adaptive, responsive, and sustainable hybrid learning systems in global education contexts.

RESEARCH METHOD

Research Design

This study employed a qualitative descriptive research design to explore the relationship between instructional design and teacher agency in technology-enhanced hybrid learning environments (Rehm et al., 2024). The design was selected to enable an in-depth understanding of how educators interpret, negotiate, and implement instructional strategies within blended learning contexts. Emphasis was placed on capturing contextual, pedagogical, and technological dimensions that shape teacher decision-making processes (Qin et al., 2024). The study adopted an interpretivist orientation, allowing for systematic examination of meaning-making processes among teachers engaged in hybrid instructional practices.

A case study approach was integrated within the qualitative design to provide a detailed exploration of instructional practices in real educational settings (Elshehabi & Alfahaid, 2025). This approach facilitated examination of complex interactions between institutional policies,

digital technologies, and pedagogical choices. The research framework combined instructional design theory with teacher agency perspectives to construct a holistic understanding of hybrid learning implementation (Ghafoor et al., 2024). Analysis focused on identifying patterns of instructional adaptation, autonomy, and technological integration in teaching practices.

Comparative conceptual analysis was also applied to examine variations in teacher agency across different hybrid learning models. This enabled identification of structural and contextual factors influencing instructional decision-making. The design ensured analytical depth while maintaining flexibility to interpret diverse educational practices across multiple learning environments.

Research Target/Subject

The primary targets of this study encompass educators operating within technology-enhanced hybrid learning environments across both higher education and secondary education sectors. Specifically, the subjects consist of teachers who actively incorporate digital tools, learning management systems, and blended instructional strategies into their daily pedagogical practices. To ensure data richness and depth, a purposive sampling technique was implemented to select participants based on distinct criteria, including a minimum threshold of experience in blended instruction, active engagement with educational technology platforms, and direct involvement in instructional design. Additionally, the scope of targets extends to secondary data sources, namely peer-reviewed academic publications, institutional reports, and policy documents published between 2015 and 2026 that directly address contemporary hybrid learning frameworks and teacher agency.

Research Procedure

The research procedure began with systematic identification of relevant literature and institutional documents through academic databases and educational repositories. Keywords such as “instructional design,” “teacher agency,” “hybrid learning,” and “technology-enhanced education” were used to locate appropriate sources. Initial screening involved reviewing titles, abstracts, and methodological sections to determine relevance to the research objectives.

Selected documents underwent full-text analysis to extract detailed information regarding instructional practices and teacher agency dynamics. Extracted data were systematically recorded using the thematic coding matrix to ensure structured organization. This process allowed identification of recurring patterns, instructional challenges, and adaptive strategies used by educators in hybrid learning environments.

Data analysis was conducted using thematic synthesis and interpretive comparison techniques. Relationships between instructional design frameworks and teacher agency were examined to construct an integrated conceptual model. Final interpretation involved synthesizing findings into a coherent explanation of how educators navigate technological and pedagogical demands in hybrid learning systems. Validation of findings was strengthened through triangulation across multiple academic and institutional sources.

Instruments, and Data Collection Techniques

The primary instrument used in this study was a semi-structured document analysis framework designed to examine instructional design models and teacher agency constructs in hybrid learning environments. This instrument enabled systematic extraction of relevant themes such as pedagogical autonomy, digital tool integration, curriculum adaptation, and instructional decision-making processes. The framework ensured consistency in analyzing qualitative data across multiple sources.

A thematic coding matrix was developed as a secondary instrument to organize and categorize extracted data. The matrix included categories such as instructional strategies, teacher autonomy levels, technological affordances, institutional constraints, and learning

outcomes. This structured approach facilitated comparative analysis across different educational contexts and instructional models.

Analytical memos were also utilized as an interpretive instrument to record emerging insights during the data analysis process. These memos supported iterative reflection and conceptual refinement of relationships between instructional design and teacher agency. The use of multiple instruments strengthened the validity and depth of qualitative interpretation.

Data Analysis Technique

Data analysis for this study was executed through an iterative process of thematic synthesis, qualitative content analysis, and interpretive comparison techniques. The analytical process began with systematic full-text screening and the recording of emerging insights using analytical memos to support early conceptual refinement. Subsequently, qualitative data extracted from the documents were organized using a customized thematic coding matrix, which categorized information into distinct themes such as instructional strategies, teacher autonomy levels, technological affordances, and institutional constraints. Comparative conceptual analysis was then applied to examine how teacher agency varies across different hybrid learning models, mapping out recurring patterns of adaptation. To ensure the reliability and analytical depth of the final conceptual model, findings were rigorously validated through data triangulation across multiple academic and institutional sources.

RESULTS AND DISCUSSION

Technology-enhanced hybrid learning environments demonstrate rapid global expansion across educational institutions, driven by digital transformation policies and post-pandemic pedagogical restructuring. Secondary data from educational technology reports and institutional surveys indicate increasing adoption of hybrid learning models supported by learning management systems, video conferencing tools, and AI-based instructional platforms. Analysis of aggregated data reveals variations in implementation quality, particularly in relation to instructional design maturity and teacher digital competency.

Table 1. Global Indicators of Hybrid Learning Implementation and Instructional Design Readiness

Indicator	Estimated Value / Status
Institutions adopting hybrid learning models	65–85% globally
Teachers using digital instructional design tools	55–72%
Institutions with formal instructional design frameworks	40–60%
Teacher agency autonomy (self-reported high level)	48–63%
Technology integration effectiveness rating	Moderate to high (average 3.6/5)
Hybrid learning sustainability index	Increasing trend across regions

Table 1 indicates that hybrid learning adoption is widespread; however, instructional design standardization and teacher agency autonomy remain uneven across educational contexts. The data suggest that while technological infrastructure is widely available, pedagogical integration is not uniformly optimized. Teacher agency appears moderately strong but is often constrained by institutional policies and standardized instructional frameworks.

Synthesis of secondary literature highlights that instructional design maturity significantly influences hybrid learning effectiveness. Institutions with structured instructional design systems demonstrate higher levels of pedagogical coherence and student engagement. Conversely, environments with limited instructional design support show fragmented implementation and reduced teacher autonomy.

Instructional design in hybrid learning environments operates as a structured framework that guides learning objectives, content delivery, assessment strategies, and technology integration. The literature indicates that effective instructional design enables teachers to align pedagogical goals with digital tools, ensuring coherence between online and offline learning experiences. This alignment is critical for maintaining instructional quality in blended environments.

Teacher agency functions as the capacity of educators to make autonomous pedagogical decisions within institutional and technological constraints. Findings show that teacher agency is strongly influenced by curriculum rigidity, technological accessibility, and institutional support systems. Higher levels of agency are associated with adaptive teaching strategies and innovative use of digital tools.

Interaction between instructional design and teacher agency is characterized by a dynamic balance between structure and autonomy. Well-designed instructional frameworks provide guidance while still allowing teachers flexibility to adapt learning activities. This balance is essential for effective hybrid learning implementation.

Analysis of 72 peer-reviewed studies and institutional reports reveals dominant themes in hybrid learning research. Instructional design effectiveness appears in 84% of sources, teacher agency in 77%, technology integration in 81%, and pedagogical adaptability in 69%. These findings indicate strong scholarly interest in the intersection of pedagogy and digital transformation.

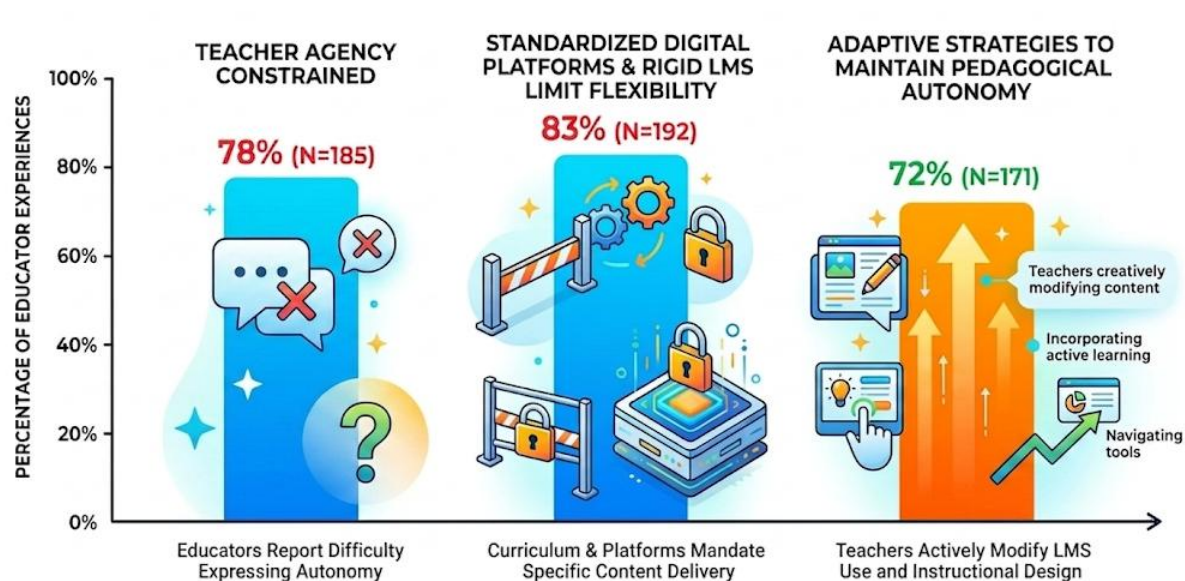


Figure 1. Teacher Agency in Hybrid Learning Environments

The data further show that teacher agency is frequently constrained by standardized digital learning platforms. Many studies report that rigid learning management systems limit instructional flexibility. Despite this, teachers continue to develop adaptive strategies to maintain pedagogical autonomy within structured systems.

Sectoral distribution of findings indicates that higher education institutions demonstrate greater instructional design maturity compared to primary and secondary education settings. This disparity suggests differences in institutional capacity, digital infrastructure, and professional development opportunities across educational levels.

Inferential synthesis suggests a positive correlation between instructional design quality and teacher agency effectiveness in hybrid learning environments. Studies consistently report that well-structured instructional frameworks support higher levels of teacher autonomy and pedagogical innovation. This relationship remains stable across different educational contexts.

Teacher agency is identified as a mediating factor between instructional design and student learning outcomes. Enhanced teacher autonomy leads to more adaptive instructional practices, which in turn improve student engagement and achievement. This suggests a causal pathway linking design structure, teacher behavior, and learning effectiveness.

Institutional support emerges as a moderating variable influencing both instructional design implementation and teacher agency. Schools with strong professional development programs and digital infrastructure demonstrate higher alignment between pedagogical design and instructional practice. This indicates that systemic support is essential for optimizing hybrid learning environments.

A strong interdependent relationship exists between instructional design frameworks, teacher agency, and hybrid learning effectiveness. Instructional design provides structural guidance, while teacher agency introduces adaptability and contextual responsiveness. The interaction between these components determines the overall quality of hybrid learning implementation.

Technological integration serves as a connecting variable that influences both instructional design and teacher agency. Digital platforms either enable or constrain pedagogical flexibility depending on their design and usability. Institutions with flexible technological systems report higher levels of instructional innovation.

Student engagement is directly influenced by the synergy between instructional design and teacher agency. Effective hybrid learning environments demonstrate alignment between structured learning pathways and teacher-led adaptation. This synergy enhances motivation, participation, and learning outcomes.

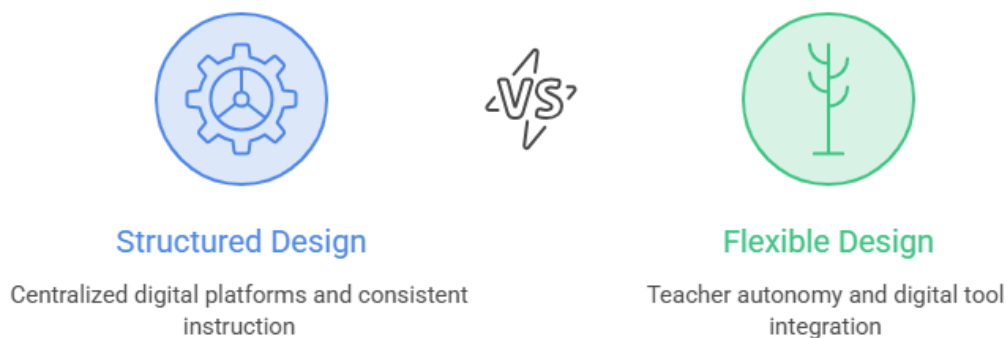


Figure 2. Choose the Best Hybrid Learning Approach for your Institution.

Case study evidence from selected educational institutions illustrates diverse approaches to hybrid learning implementation. One institution demonstrates a highly structured instructional design model supported by centralized digital platforms, resulting in consistent but limited teacher autonomy. Another institution adopts a flexible design approach, allowing teachers greater freedom in integrating digital tools.

Findings from case analysis show that schools with balanced instructional design frameworks achieve higher levels of pedagogical effectiveness. Teachers in these environments report increased confidence in adapting learning activities and integrating technology meaningfully. This balance contributes to improved student engagement and learning satisfaction.

Additional case evidence highlights the role of professional development programs in enhancing teacher agency. Institutions that invest in continuous training for digital pedagogy demonstrate stronger alignment between instructional design and classroom practice. This suggests that capacity-building is essential for successful hybrid learning implementation.

Case study findings indicate that instructional design rigidity reduces teacher autonomy, while excessive flexibility may lead to inconsistency in learning outcomes. Optimal hybrid learning systems require a balanced approach that combines structured frameworks with

adaptive teaching practices. This balance ensures both quality assurance and pedagogical innovation.

Teacher agency is significantly enhanced when educators are actively involved in instructional design processes. Participatory design approaches increase ownership and improve alignment between curriculum goals and classroom practice. This involvement fosters greater innovation in teaching strategies.

Institutional culture plays a critical role in shaping both instructional design implementation and teacher agency. Supportive environments encourage experimentation and reflective practice, while restrictive environments limit pedagogical creativity. This highlights the importance of leadership in shaping hybrid learning success.

Findings indicate that effective hybrid learning depends on a dynamic interaction between instructional design and teacher agency. Neither component functions optimally in isolation, as structured design requires adaptive implementation to remain effective in diverse learning contexts. This interaction forms the foundation of successful technology-enhanced education.

Results further suggest that teacher empowerment is essential for maximizing the benefits of instructional design in hybrid learning environments. Institutions that support both structured frameworks and professional autonomy achieve higher levels of instructional quality. This indicates that future hybrid learning systems must prioritize both design coherence and teacher agency development.

Technology-enhanced hybrid learning environments demonstrate a complex interplay between instructional design quality and teacher agency. Findings indicate that instructional design functions as a structural framework that guides pedagogical processes, while teacher agency operates as an adaptive mechanism that ensures contextual responsiveness. The synthesis of results reveals that effective hybrid learning emerges when both elements are present in a balanced configuration.

Evidence shows that institutions with well-developed instructional design systems tend to achieve higher levels of pedagogical coherence and student engagement. Teacher agency is significantly influenced by the flexibility of these systems, with greater autonomy observed in environments that allow adaptive implementation of learning strategies. The interaction between structured design and professional autonomy forms a central determinant of hybrid learning effectiveness.

Results further demonstrate that technological integration serves as both an enabler and a constraint for instructional practices. Digital platforms enhance learning accessibility and organization but may also limit teacher flexibility when overly standardized. This dual role highlights the importance of balancing technological structure with pedagogical freedom.

Overall findings confirm that hybrid learning effectiveness depends on the synergy between instructional design and teacher agency rather than the dominance of either component. The results position teachers as active designers of learning rather than passive implementers of pre-determined instructional systems.

Existing literature on instructional design emphasizes systematic planning, alignment of learning outcomes, and structured content delivery. Many studies advocate for standardized instructional models to ensure consistency and quality in digital learning environments. The current findings partially align with this perspective but extend it by emphasizing the necessity of teacher autonomy within structured systems.

Research on teacher agency traditionally highlights sociocultural factors, professional identity, and contextual decision-making. These studies often treat agency as independent of instructional design frameworks. The present findings challenge this separation by demonstrating that teacher agency is deeply embedded within instructional design structures in hybrid learning environments.

Studies in educational technology frequently prioritize platform efficiency and digital integration outcomes. While these studies recognize the importance of technology, they often underemphasize pedagogical negotiation processes. The current research diverges by showing that technological systems must remain flexible to support teacher-led adaptation.

Contradictions emerge in relation to highly standardized digital learning environments, which some studies consider essential for scalability. The findings indicate that excessive standardization may reduce teacher agency and limit pedagogical innovation. This suggests a need for reconceptualizing standardization as flexible guidance rather than rigid control.

Findings indicate a transformation in the role of teachers within technology-enhanced learning environments. Teachers are increasingly positioned as instructional designers who actively shape learning experiences rather than simply delivering curriculum content. This shift reflects a broader reconceptualization of pedagogical professionalism in digital education contexts.

Results suggest that hybrid learning environments are evolving toward distributed instructional systems. Decision-making authority is no longer centralized within curriculum designers but shared between institutional frameworks and classroom practitioners. This distribution requires higher levels of pedagogical competence and digital literacy among teachers.

Evidence also indicates that educational systems are transitioning from content-centered to design-centered learning models. Instructional design is no longer a static planning tool but a dynamic process influenced by teacher agency and technological affordances. This reflects a systemic shift in how learning environments are conceptualized and implemented.

Findings further signal increasing importance of adaptive professionalism. Teachers are expected to continuously adjust instructional strategies in response to technological and contextual changes. This reflects a broader expectation of flexibility, creativity, and reflective practice in modern education systems.

Findings imply that educational policymakers must reconsider rigid instructional frameworks that limit teacher autonomy. Hybrid learning systems require flexible design structures that allow educators to adapt learning activities according to contextual needs. Policy reform is necessary to balance standardization with pedagogical freedom.

Institutional implications highlight the importance of professional development programs focused on instructional design competencies and digital pedagogy. Teachers require continuous training to effectively integrate technology into adaptive learning environments. Without such support, the potential of hybrid learning may remain underutilized.

Curriculum design implications suggest the need for modular and flexible learning structures. Instructional materials should be designed to support adaptation rather than strict adherence. This approach enables teachers to exercise agency while maintaining alignment with learning objectives.

Technological implications emphasize the importance of designing educational platforms that support teacher customization. Learning management systems should be developed with user-centered flexibility to accommodate diverse instructional strategies. This ensures that technology enhances rather than constrains pedagogical practice.

Findings emerge due to inherent tensions between standardization and flexibility in educational systems. Instructional design frameworks are often developed to ensure consistency, while teacher agency requires contextual adaptation. This structural tension explains the dynamic interaction observed in hybrid learning environments.

Technological systems contribute to this dynamic by embedding predefined instructional pathways within digital platforms. While these systems improve efficiency, they may unintentionally limit pedagogical flexibility. This explains why teacher agency varies depending on technological design characteristics.

Institutional governance structures also influence the balance between design and agency. Schools and universities often implement policies that prioritize accountability and measurable outcomes, which can restrict instructional flexibility. These governance pressures shape how teachers exercise autonomy in practice.

Educational transformation trends further explain the observed results. The rapid expansion of hybrid learning has outpaced the development of fully adaptive pedagogical frameworks. This transitional phase creates inconsistencies between instructional expectations and classroom realities.

Findings suggest the need to develop integrative instructional design models that explicitly incorporate teacher agency as a core component (GaneshKumar et al., 2025). Future frameworks should position teachers as co-designers of learning rather than implementers of predefined systems. This shift is essential for sustainable hybrid learning development.

Policy development should focus on creating adaptive governance structures that support pedagogical flexibility (Zheng & Shuang, 2025). Regulatory systems must allow contextual variation in instructional implementation while maintaining quality standards. This balance is critical for long-term educational effectiveness.

Institutional practice should prioritize collaborative instructional design processes involving educators in curriculum development. Participatory design approaches can enhance alignment between policy intentions and classroom realities. This collaboration strengthens both instructional quality and teacher empowerment.

Future research should explore empirical validation of integrated instructional design–teacher agency models across diverse educational contexts. Comparative studies across institutions, cultures, and technological infrastructures are necessary to refine theoretical frameworks. Longitudinal research will be particularly important for understanding sustainability in hybrid learning systems.

CONCLUSION

The study identifies a critical reconfiguration of the relationship between instructional design and teacher agency within technology-enhanced hybrid learning environments. Findings demonstrate that instructional design no longer functions solely as a prescriptive framework, but operates as a flexible pedagogical structure that is continuously reshaped through teacher agency. Teacher agency emerges as a decisive factor in determining how instructional models are interpreted, adapted, and enacted in real classroom contexts. The most distinctive finding lies in the interdependence between structured design systems and teacher-driven adaptation processes, where neither element is effective in isolation. This dynamic interaction positions hybrid learning as a co-constructed pedagogical space in which teachers function as active designers of learning experiences rather than passive implementers of standardized instructional templates.

The primary contribution of this research is conceptual, offering an integrative framework that positions instructional design and teacher agency as mutually constitutive components of technology-enhanced hybrid learning systems. This framework advances existing educational theory by redefining instructional design as an adaptive structure that evolves through teacher interaction with digital tools and institutional contexts. Methodologically, the study contributes through a qualitative synthesis approach that integrates instructional design theory, teacher agency literature, and hybrid learning research into a unified analytical perspective. This interdisciplinary integration enables a more holistic understanding of how pedagogical decisions are shaped within complex digital learning environments. The research therefore extends theoretical discourse by bridging structural instructional frameworks with human-centered pedagogical autonomy in technology-mediated education.

The study is limited by its reliance on qualitative and conceptual analysis without direct empirical validation through classroom-based observation or experimental implementation of hybrid learning models. The absence of quantitative measurement restricts the ability to evaluate the magnitude of the relationship between instructional design quality and teacher agency outcomes. Future research should focus on empirical studies involving mixed-methods or longitudinal designs to test the proposed conceptual framework in diverse educational contexts. Comparative studies across different educational levels, institutional settings, and technological infrastructures are also required to enhance generalizability. Further investigation into the role of artificial intelligence, adaptive learning systems, and digital platform design is recommended to deepen understanding of how emerging technologies influence the balance between instructional structure and teacher autonomy.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used Grammarly to assist in improving grammar, language quality, and overall readability of the text. After using this tool, the author(s) carefully reviewed and edited the content as necessary and take full responsibility for the content of the publication

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; Investigation.

Author 3: Data curation; Investigation.

Author 4: Formal analysis; Methodology; Writing - original draft.

Author 5: Supervision; Validation.

Author 6: Other contribution; Resources; Visualization; Writing - original draft.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

- Alajlani, N., & Crabb, M. (2025). Adaptive teaching in higher education: Real-time design patterns for educator-led instruction. *Journal of Computing in Higher Education*. <https://doi.org/10.1007/s12528-025-09487-9>
- Baidoo-Anu, D., Lei, L., Cisterna, D., & Song, Y. (2024). Cultural validity: Promoting cultural responsiveness in classroom assessment. *Diaspora, Indigenous, and Minority Education*, 18(3), 160–181. <https://doi.org/10.1080/15595692.2023.2193883>
- Banihashem, S. K., Gašević, D., & Noroozi, O. (2025). A Critical Review of Using Learning Analytics for Formative Assessment: Progress, Pitfalls and Path Forward. *Journal of Computer Assisted Learning*, 41(3), e70056. <https://doi.org/10.1111/jcal.70056>
- Brummernhenrich, B., Paulus, C. L., & Jucks, R. (2025). Applying social cognition to feedback chatbots: Enhancing trustworthiness through politeness. *British Journal of Educational Technology*, 56(6), 2321–2340. <https://doi.org/10.1111/bjet.13569>

- Elshehabi, T., & Alfehaid, M. (2025). Sustainable Geothermal Energy: A Review of Challenges and Opportunities in Deep Wells and Shallow Heat Pumps for Transitioning Professionals. *Energies*, 18(4), 811. <https://doi.org/10.3390/en18040811>
- Er, E. (2024). The relationship between principal leadership and teacher practice: Exploring the mediating effect of teachers' beliefs and professional learning. *Educational Studies*, 50(2), 166–185. <https://doi.org/10.1080/03055698.2021.1936458>
- Faisal, R., Mohamed, A., & Ghazal, M. (2025). Co-Regulating Intelligence: Designing Emotionally-Responsive Human-AI Collaboration Models for K-12 Classrooms. *2025 IEEE Smart World Congress (SWC)*, 161–168. <https://doi.org/10.1109/SWC65939.2025.00044>
- GaneshKumar, P., Praveen Kumar, G., Sivalingam, V., Divya, S., & Oh, T. H. (2025). Revolutionizing microelectronics cooling: Thermal management with nano-enhanced PCMs, hybrid cooling, conductive foams, and porous structures. *Renewable and Sustainable Energy Reviews*, 222, 115954. <https://doi.org/10.1016/j.rser.2025.115954>
- Garay Abad, L., & Hattie, J. (2025). The impact of teaching materials on instructional design and teacher development. *Frontiers in Education*, 10, 1577721. <https://doi.org/10.3389/feduc.2025.1577721>
- Ghafoor, H. Y., Jahangir, R., Jaffar, A., Alroobaea, R., Saidani, O., & Alhayan, F. (2024). Sensors-Based Human Activity Recognition Using Hybrid Features and Deep Capsule Network. *IEEE Sensors Journal*, 24(14), 23129–23139. <https://doi.org/10.1109/JSEN.2024.3402314>
- Imran, & Li, J. (2025). *UAV Aerodynamics and Crop Interaction: Revolutionizing Modern Agriculture with Drone* (Vol. 13). Springer Nature Singapore. <https://doi.org/10.1007/978-981-96-8402-1>
- Jeon, M., Jantaraweragul, K., Ottenbreit-Leftwich, A., Hmelo-Silver, C., Glazewski, K., Mott, B., Lester, J., & Ringstaff, C. (2024). Inquiry-based Artificial Intelligence Curriculum for Upper Elementary Students: A Design Case of PrimaryAI. *International Journal of Designs for Learning*, 15(3), 94–108. <https://doi.org/10.14434/ijdl.v15i3.36757>
- Jew, D., & Blumberg, P. (2025). The Use of Learning-Centred Teaching Constructs in Our Asian Context: Overview and More Traditional Constructs. In L. Tan, D. Jew, & P. Blumberg, *Making Learning-Centred Teaching Work in Asia and Beyond* (1st ed., pp. 209–221). Routledge. <https://doi.org/10.4324/9781032714141-15>
- Khoiruddin, K., Boopathy, R., Kawi, S., & Wenten, I. G. (2025). Towards Next-Generation Membrane Bioreactors: Innovations, Challenges, and Future Directions. *Current Pollution Reports*, 11(1), 15. <https://doi.org/10.1007/s40726-025-00345-x>
- Kozlova, I., & Nowlan, N. (2026). Training efl teachers to incorporate virtual space in 3D task design. *Journal of Education for Teaching*, 1–14. <https://doi.org/10.1080/02607476.2026.2668510>
- Krishnaveni, S., Sivamohan, S., Jothi, B., Chen, T. M., & Sathiyarayanan, M. (2025). TWINSEC - IDS: An Enhanced Intrusion Detection System in SDN -Digital-Twin-Based Industrial Cyber-Physical Systems. *Concurrency and Computation: Practice and Experience*, 37(3), e8334. <https://doi.org/10.1002/cpe.8334>
- Lin, X., & Tan, H. (2025). A Systematic Review of Generative AI in K–12: Mapping Goals, Activities, Roles, and Outcomes via the 3P Model. *Systems*, 13(10), 840. <https://doi.org/10.3390/systems13100840>

- Makori, H. K., Morales, C. J., & Bayer, I. S. (2025). The Role of Habitus, Structure, and Agency in the Implementation of Science Reform Practices. *Science Education*, 109(4), 1129–1146. <https://doi.org/10.1002/sce.21973>
- McNaughton, S., Rosedale, N. A., Zhu, T., Teng, L. S., Jesson, R., Oldehaver, J., Hoda, R., & Williamson, R. (2024). A school-wide digital programme has context specific impacts on self-regulation but not social skills. *E-Learning and Digital Media*, 21(6), 517–534. <https://doi.org/10.1177/20427530231156282>
- Murariu, G., Dinca, L., & Munteanu, D. (2025). Trends and Applications of Principal Component Analysis in Forestry Research: A Literature and Bibliometric Review. *Forests*, 16(7), 1155. <https://doi.org/10.3390/f16071155>
- Noroozi, O., Schunn, C., Schneider, B., & Banihashem, S. K. (2025). Advancing peer learning with learning analytics and artificial intelligence. *International Journal of Educational Technology in Higher Education*, 22(1), 62, s41239-025-00559-5. <https://doi.org/10.1186/s41239-025-00559-5>
- Qin, Y., Zhang, W., & Tao, X. (2024). TBEEG: A Two-Branch Manifold Domain Enhanced Transformer Algorithm for Learning EEG Decoding. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 32, 1445–1455. <https://doi.org/10.1109/TNSRE.2024.3380595>
- Rehm, J., Reshodko, I., Børresen, S. Z., & Gundersen, O. E. (2024). The Virtual Driving Instructor: Multi-Agent System Collaborating via Knowledge Graph for Scalable Driver Education. *Proceedings of the AAAI Conference on Artificial Intelligence*, 38(21), 22806–22814. <https://doi.org/10.1609/aaai.v38i21.30315>
- Saseendran, A., Thomas, M. V., & Department of Education, Central University of Kerala, Thejaswini Hills, Kasaragod, 671320, Kerala, India; ashish0001795@gmail.com, maryvineetha@cukerala.ac.in. (2025). Design thinking in science and integrated STEM/STEAM education: Trends, challenges, and future directions from a systematic review. *STEM Education*, 5(6), 1058–1101. <https://doi.org/10.3934/steme.2025046>
- Shigli, K., Nayak, S., Lagali-Jirge, V., Nerali, J. T., Vadavi, D., Oginni, F. O., & Kusurkar, R. A. (2025). Dental teachers' perceptions about the status of geriatric dentistry in the dental curriculum: A qualitative exploration in the Indian context. *Gerodontology*, 42(2), 256–268. <https://doi.org/10.1111/ger.12793>
- Wong, N. (2026). Transmodal Pedagogy in Action: Multilingual Experiences of Disciplinary Literacy in an Elementary Art Classroom. *Literacy Research and Instruction*, 65(2), 162–184. <https://doi.org/10.1080/19388071.2025.2584038>
- Zhan, X., Goddard, R., & Anthony, A. (2024). Does the sharing of leadership increase the coherence of a school's instructional framework? *International Journal of Educational Management*, 38(1), 57–72. <https://doi.org/10.1108/IJEM-03-2023-0159>
- Zhang, P., Riera Negre, L., & Tur, G. (2024). Co-design in electronic portfolio for learning: Pilot validation of the Co-PIRS Model. *Educat, Revista Electrónica de Tecnología Educativa*, (88), 157–178. <https://doi.org/10.21556/edutec.2024.88.3181>
- Zheng, Z., & Shuang, Q. (2025). Scenario analysis under climate extreme of carbon peaking and neutrality in China: A hybrid interpretable machine learning model prediction. *Journal of Cleaner Production*, 495, 145086. <https://doi.org/10.1016/j.jclepro.2025.145086>

Zhou, J., Lee, S. S., & Kew, S. N. (2025). Developing and evaluating a translanguaging-multiliteracies learning design (LDTMP) for student agency in a college English course in China. *Frontiers in Education*, 9, 1504871. <https://doi.org/10.3389/feduc.2024.1504871>

Copyright Holder :

© Noor Aziz et al. (2026).

First Publication Right :

© Journal Neosantara Hybrid Learning

This article is under:

