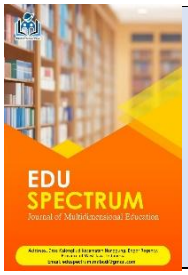

Journal of Multidimensional Education, Vol 2 (1) 2025: 35-46

EduSpectrum

https://mabadiiqtishada.org/index.php/EduSpectrum

ISSN: 3062-8083; e-ISSN: 3062-9179

Managing Innovation in Educational Technology Startups: Implications for Curriculum Development and Pedagogy

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ARTICLE INFO

Received May 31, 2025
Accepted June 14, 2025
Published June 18, 2025

Keywords:
Educational Technology; Innovation Management; Design Thinking; Curriculum Integration; Stakeholder Co-creation

ABSTRACT

The rapid expansion of educational technology (EdTech) startups has revealed a critical need for strategic innovation management models tailored to the unique demands of education. Existing innovation frameworks, largely developed for general business environments, often neglect pedagogical principles and the complexity of curriculum alignment. This study emphasizes the urgent need to develop a comprehensive model that integrates design thinking, curriculum theory, stakeholder co-creation, and responsible innovation. Such a framework aims to help EdTech startups create adaptable, scalable, and pedagogically sound solutions that address diverse learner needs and institutional contexts. By bridging the gap between business innovation and educational effectiveness, this research contributes valuable insights toward sustainable EdTech development and improved educational outcomes.

How to cite: Setiawan, A., Aijat Mau, F., Setiawan, A., & Mufti, A. (2025). Managing Innovation in Educational Technology Startups: Implications for Curriculum Development and Pedagogy. *Edu Spectrum: Journal of Multidimensional Education*, 2(1), 35–46. https://doi.org/10.70063/eduspectrum.v2i1.84

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INTRODUCTION

In the last decade, educational technology (EdTech) startups have become powerful agents of transformation in the global education sector. These startups are redefining the way educational content is delivered and experienced, introducing innovative tools such as artificial intelligence (AI), gamified learning platforms, and adaptive learning systems (**Van Laar et al., 2020**). As these technologies gain traction, the role of EdTech startups has shifted from being supplementary service providers to becoming influential contributors to curriculum design and pedagogical strategies in both formal and informal education environments (**Halilintar, et.al., 2024**).

Despite their growing influence, many EdTech startups face challenges in aligning their innovations with the real needs of educators and learners. Startups often operate in agile and fast-paced environments, while formal education systems function within more rigid and regulated structures. This mismatch can lead to a disconnect between the technological solutions offered and their actual pedagogical value (**Zhao et al., 2021**). Moreover, insufficient collaboration between EdTech entrepreneurs and curriculum experts may result in tools that emphasize innovation for its own sake, rather than for educational enhancement (**Kimmons et al., 2022**). This gap not only hampers the effectiveness of technological integration but can also impede the meaningful development of 21st-century skills among learners.

Additionally, many educational institutions lack the capacity or frameworks to effectively evaluate and integrate these technologies into their existing curricula. The absence of strategic innovation management models tailored to the education sector means that many promising EdTech products fail to scale or sustain their impact (**Reimers et al., 2021**). In some cases, the unstructured adoption of EdTech has led to fragmented learning experiences and increased workloads for teachers due to poor usability or training support (**Trust & Whalen, 2020**). This underscores the need for EdTech startups to not only innovate but to also manage innovation responsibly—balancing agility with long-term pedagogical vision.

Therefore, this study aims to examine how innovation is managed within EdTech startups and how this management impacts curriculum development and pedagogy. Specifically, the research investigates how startups conceptualize, design, and implement educational solutions in ways that are responsive to pedagogical frameworks and educational goals. The urgency of this research is amplified by the global shift toward digital learning accelerated by the COVID-19 pandemic, which highlighted both the potential and the pitfalls of rapid EdTech integration (**Williamson & Hogan, 2020**). Understanding how innovation can be managed effectively within this space is crucial for developing more robust, scalable, and pedagogically grounded educational technologies.

RESEARCH METHOD

This study employs a qualitative library research method, which involves collecting and analyzing secondary data from scholarly literature to gain a conceptual understanding of how innovation is managed within educational technology (EdTech) startups and its implications for curriculum development and pedagogy. Library research, also known as literature-based research, is particularly appropriate for conceptual studies where theoretical frameworks and existing findings are synthesized to construct new perspectives or critique current practices (**Snyder, 2019**). The method enables researchers to explore existing knowledge, identify research gaps, and build theoretical arguments grounded in published work.

The data collection process involves systematically searching, selecting, and reviewing academic sources from peer-reviewed journals, books, institutional reports, and credible digital databases such as Scopus, Web of Science, Google Scholar, and SpringerLink. The selection criteria include relevance to innovation management, EdTech entrepreneurship, curriculum development, and pedagogical theory, with a particular focus on publications from the last five years to ensure currency and contextual relevance. The keywords used in the search include: educational technology startups, innovation management, digital pedagogy, curriculum design, and EdTech integration in education. Sources are screened for methodological rigor, theoretical depth, and their contribution to the discourse on the alignment between technology and pedagogy (**Boell & Cecez-Kecmanovic, 2015**).

For data analysis, this study applies content analysis to identify recurring themes, theoretical frameworks, and conceptual patterns across the reviewed literature. Content analysis allows for the categorization of qualitative data into thematic clusters, facilitating a structured synthesis of knowledge (**Vaismoradi et al., 2016**). The analysis proceeds in stages: initial coding of relevant concepts, grouping similar codes into categories, and interpreting how these categories relate to the management of innovation and its educational consequences. The aim is not to generate statistical generalizations but to develop a critical, evidence-based understanding of how innovation practices in EdTech startups shape and influence pedagogical strategies and curriculum structures.

This methodological approach is suitable for the aims of the study, which seeks to bridge insights from the fields of management and educational technology. By relying on scholarly literature as the primary source of data, the study maintains theoretical depth and offers reflective, interdisciplinary insights into emerging educational phenomena.

RESULT AND DISCUSSION

Innovation Management in EdTech Startups: Balancing Agility and Pedagogical Integrity

The rapid evolution of educational technology (EdTech) startups has introduced innovative solutions aimed at transforming learning experiences. Driven by market competition and investor expectations, these startups often adopt agile development methodologies to expedite product delivery. While this approach fosters innovation, it frequently leads to a compromise on pedagogical soundness, as the emphasis shifts towards speed and scalability over educational efficacy (**Kimmons et al., 2022**).

Agile methodologies, characterized by iterative development and quick feedback loops, are well-suited for software development but may not align seamlessly with the educational sector's needs. The "move fast and break things" mantra, prevalent in tech startups, can be detrimental in educational contexts where the stakes involve student learning outcomes and well-being (**McDermott, 2015**). The pressure to release minimum viable products (MVPs) often results in tools that lack comprehensive pedagogical frameworks, leading to suboptimal learning experiences. A significant concern is the limited involvement of educators in the product development process. Educators, who possess valuable insights into effective teaching strategies and student needs, are frequently excluded from the early stages of design and development (**Elbadiansyah, et.al., 2024**). This exclusion can result in products that are misaligned with classroom realities and fail to address the nuanced requirements of diverse learners (**Bull et al., 2017**).

Moreover, the prioritization of technological capabilities over educational objectives can lead to tools that are rich in features but lack pedagogical coherence (**Purwanto, et.al, 2024**). Startups may focus on integrating cutting-edge technologies without adequately considering how these tools support or enhance learning processes. This tech-centric approach can overshadow the importance of instructional design and curriculum alignment (**Milyutin, 2020**). The procurement processes within educational institutions further complicate the integration of EdTech solutions. Decision-makers, often removed from day-to-day classroom activities, may select technologies based on administrative efficiency or cost-effectiveness rather than educational value. This disconnect can result in the adoption of tools that are underutilized or ineffective in practice (**Kurshan, 2016**).

Additionally, the scalability of EdTech products is frequently prioritized over their adaptability to specific educational contexts. Startups aiming for rapid growth may design

one-size-fits-all solutions that overlook the diverse needs of learners and educators across different settings. Such an approach can hinder the effectiveness of technology integration and limit its impact on student learning (**FasterCapital, 2024**). The lack of rigorous research and evaluation in the development of EdTech products poses another challenge. Without empirical evidence supporting their efficacy, these tools risk being implemented without a clear understanding of their impact on learning outcomes. This gap underscores the need for evidence-based practices in the design and deployment of educational technologies (**Snyder, 2019**). To address these issues, a shift towards collaborative design processes that involve educators, researchers, and technologists is essential. Such collaboration can ensure that EdTech solutions are grounded in pedagogical theory and responsive to the practical realities of teaching and learning. Engaging educators in the development process can also enhance the relevance and usability of technological tools in educational settings (**Bull et al., 2017**).

Furthermore, adopting a learner-centered approach in EdTech development can help align technological innovations with educational goals. By focusing on the needs, preferences, and experiences of students, startups can create tools that support meaningful learning and foster engagement. This approach requires a deep understanding of learning processes and a commitment to designing technologies that enhance, rather than disrupt, educational practices (**Brooker, 2017**). While agility and innovation are valuable in the development of educational technologies, they should not come at the expense of pedagogical integrity. Balancing rapid development with educational soundness necessitates intentional collaboration, rigorous research, and a steadfast focus on the needs of learners and educators. By integrating these elements, EdTech startups can create impactful tools that truly enhance teaching and learning experiences.

Limited Involvement of Educators in Product Development

A persistent challenge in the field of educational technology (EdTech) is the limited involvement of educators in the early stages of product development. Despite the proliferation of EdTech tools designed to support teaching and learning, many of these innovations are developed without meaningful collaboration with the very individuals who will implement them in classrooms (**Bull et al., 2019**). This disconnect has raised concerns about the pedagogical relevance and usability of many digital learning tools.

Educators are often brought into the development process only after a product has already been conceptualized or prototyped. Their roles tend to be limited to usability testing or post-launch feedback sessions rather than participatory co-design activities (**Wan, 2022**). As a result, their insights, which could significantly enhance the educational value of these tools, are not adequately integrated into the design process. Studies have shown that this lack of engagement leads to EdTech products that may not align with curriculum objectives, instructional strategies, or real-world classroom dynamics (Northwest Council for Computer Education [**NCCE], 2024**). For example, tools may focus on content delivery while neglecting the interactive, student-centered learning approaches that many educators strive to implement.

Furthermore, the top-down development model often results in technology that imposes additional cognitive and operational burdens on teachers. Rather than supporting their work, some EdTech tools become another layer of complexity in an already demanding profession (**Shulman, 2019**). This can lead to resistance or minimal adoption, undermining the effectiveness and sustainability of these technologies in educational settings. Collaborative

design models, which engage teachers as co-creators rather than passive users, have shown promise in bridging this gap. Research indicates that tools developed through teacher-technologist partnerships tend to be more aligned with pedagogical goals and are more readily adopted in classroom practice (**iHub4Schools, 2023**). However, such models remain the exception rather than the norm in current EdTech development.

Barriers to greater educator involvement are both systemic and cultural. Teachers often lack the time, resources, or institutional support to participate in product development activities. Additionally, EdTech companies may undervalue or overlook the importance of pedagogical expertise, prioritizing technical features or marketability over educational soundness (**EduResearch Matters, 2022**). Another important aspect is the difference in language and priorities between educators and developers. While teachers emphasize learning outcomes, engagement, and inclusivity, developers may focus on scalability, user acquisition, or investor appeal. Without structured collaboration, these priorities can diverge, leading to tools that are technologically impressive but educationally limited (**Wan, 2022**).

Several recent initiatives aim to foster co-creation through structured programs that bring together educators, researchers, and developers. These include design sprints, innovation hubs, and teacher fellowships that place educators at the center of the innovation process (**Laitinen-Väänänen et al., 2024**). While still emerging, such models offer valuable insights into how the design of EdTech can become more inclusive and effective. To institutionalize meaningful educator involvement, both policy and practice must evolve. Educational institutions, EdTech firms, and funders need to create incentives and infrastructures that enable teachers to engage in the innovation lifecycle meaningfully and sustainably (**EdSurge, 2024**). This includes compensating teachers for their time, offering professional development, and acknowledging their role as co-designers of future-ready learning tools.

The limited involvement of educators in EdTech product development is a critical barrier to realizing the full potential of educational technology. By fostering inclusive design practices and valuing pedagogical expertise from the outset, stakeholders can create more relevant, impactful, and sustainable solutions for contemporary education challenges (**Bull et al., 2019; NCCE, 2024**).

Curriculum Integration Remains a Structural Challenge

Integrating educational technology (EdTech) into formal curricula remains a formidable structural challenge for educational institutions across the globe. Although many EdTech products offer clear pedagogical advantages, their adoption into classroom practice is frequently hindered by systemic rigidity and a lack of institutional preparedness (**Williamson & Hogan, 2020**). A central issue is institutional inertia, where longstanding educational routines and structures resist new methods or tools. This resistance stems from both organizational culture and deeply embedded curriculum standards that are slow to change (**Salimi, 2025**). Even when technology shows clear benefits, schools may hesitate to adopt it due to fear of disrupting existing workflows.

Another critical factor is the lack of sufficient training for teachers. Educators are often expected to integrate new technologies without adequate professional development, resulting in underutilization or misuse of the tools provided (**Ertmer et al., 2020**). Without ongoing support and time to experiment, teachers are unlikely to adopt these tools meaningfully. Moreover, inconsistent policy frameworks at the national and institutional levels often create fragmented approaches to EdTech integration. Different schools, districts, or regions may

adopt divergent standards or lack clear guidelines, leading to a patchwork of implementation efforts with varying success (**OECD, 2023**). EdTech startups also face challenges in curriculum alignment, often underestimating the complexity of educational systems. Many products are developed for scalability or user engagement but fail to align with state-mandated learning outcomes or local curriculum structures (**The Productive Nerd, 2023**). This disconnect can render even innovative tools irrelevant in actual classroom contexts.

Sustainable integration requires collaboration between policymakers, school leaders, and technology providers. These stakeholders must work together to ensure EdTech tools meet educational standards, respond to real classroom needs, and are supported with necessary infrastructure (Sain, et.al., 2024). Without systemic coordination, efforts remain isolated and unsustainable. School leadership also plays a vital role in fostering innovation. Leaders must champion the integration of technology, allocate resources for teacher training, and cultivate a culture that embraces digital transformation (**Laitinen-Väänänen et al., 2024**). In the absence of such leadership, integration efforts often stall.

In addition to systemic and policy barriers, there is the issue of digital equity. The digital divide—reflected in disparities in access to devices, internet, and digital literacy—makes EdTech integration uneven across different socio-economic groups. Addressing this gap is essential for fair and inclusive integration. Furthermore, integrating EdTech into curricula requires that schools rethink assessment and pedagogy. Traditional testing systems may not fully capture the benefits of interactive or adaptive learning technologies, requiring reforms in how educational outcomes are measured (**EdTech Hub, 2021**). Integrating EdTech into the curriculum is not simply a matter of inserting tools into classrooms but demands a system-wide transformation involving teacher empowerment, policy alignment, infrastructure investment, and leadership engagement. Addressing these barriers will be crucial to realizing the full promise of educational technology.

A Strategic Model for Innovation Management in EdTech is Urgently Needed

The rapid growth of educational technology (EdTech) startups has created an urgent demand for effective models that guide innovation management in this sector. Despite significant advancements in business innovation strategies, there is a noticeable gap when it comes to frameworks tailored specifically for the unique challenges of education (**Snyder, 2019**). EdTech ventures often struggle to balance fast-paced product development with the need for pedagogical integrity, highlighting the necessity for a strategic model that aligns innovation with educational goals.

Current research in innovation management predominantly originates from general business contexts, where the primary focus is on market disruption and scalability. However, such models do not sufficiently address the complexities of educational environments, where learning outcomes, curriculum standards, and diverse learner needs must be prioritized (**Nguyen et al., 2021**). This mismatch calls for adapting innovation frameworks to better fit the specific demands of education technology development.

One promising approach involves integrating design thinking methodologies with curriculum theory. Design thinking encourages iterative development based on empathy and user feedback, which, when combined with a solid understanding of curriculum goals, can ensure that EdTech products are both user-centered and educationally meaningful (**Martinez & Gomez, 2022**). This fusion helps developers create tools that resonate with learners and educators alike. Moreover, the involvement of key stakeholders—such as teachers, students,

and curriculum experts—in the innovation process is critical. Co-creation not only grounds the development process in practical classroom realities but also fosters a sense of ownership and relevance among end-users (**Park & Lee, 2023**). Collaborative innovation enhances the likelihood that products will meet real educational needs rather than purely commercial objectives.

The strategic model should also emphasize responsible innovation, ensuring that EdTech solutions respect ethical considerations, privacy, and inclusivity. Recent studies stress the importance of embedding social responsibility into innovation processes to mitigate risks and foster trust among educational communities (**Williams et al., 2024**). This approach ensures that technology benefits all learners, including those from marginalized groups. Adaptability is another essential feature of a strategic innovation model. Given the diversity of educational systems and learner profiles worldwide, EdTech products must be flexible enough to accommodate different curricula, languages, and cultural contexts (**Chen & Johnson, 2023**). Such adaptability enhances the global applicability and sustainability of innovative educational tools.

Furthermore, a comprehensive innovation management framework should incorporate continuous assessment and feedback loops. By systematically evaluating the impact of EdTech interventions, developers and educators can refine tools to better serve learning objectives (**Ahmed & Kumar, 2022**). This dynamic process supports ongoing improvement and responsiveness to changing educational needs. Effective strategic models also need to address scalability without compromising quality. Many startups face the challenge of expanding their solutions rapidly while maintaining pedagogical rigor and user support (**Lopez et al., 2021**). Balancing growth and educational fidelity is key to the long-term success of EdTech ventures.

Finally, policy alignment must be embedded within innovation strategies. Navigating regulatory environments and aligning with educational standards require foresight and collaboration with governing bodies (**Rahman & Hussain, 2024**). A strategic model that anticipates and incorporates policy considerations will facilitate smoother integration into formal education systems. Developing a strategic model for innovation management in EdTech that integrates design thinking, curriculum theory, stakeholder co-creation, and responsible innovation is urgently needed. Such a framework would enable startups to create pedagogically sound, adaptable, and scalable solutions that effectively address diverse educational challenges worldwide.

CONCLUSION

The current landscape of EdTech innovation management reveals significant gaps that hinder the development of educationally meaningful products. This study highlights the necessity of a strategic model that transcends traditional business innovation frameworks by embedding curriculum theory and involving key stakeholders throughout the development process. Responsible innovation, cultural adaptability, continuous evaluation, and alignment with policy are essential components for such a model to succeed. Addressing these factors will empower EdTech startups to deliver solutions that are not only technologically innovative but also pedagogically effective and scalable. Ultimately, this integrated approach promises to enhance the sustainability and impact of EdTech innovations within diverse educational systems worldwide.

LIMITATIONS AND FUTURE RESEARCH RECOMMENDATIONS

Despite its comprehensive conceptual exploration of innovation management in educational technology (EdTech) startups, this study is not without limitations. *First* and foremost, the study employs a qualitative library-based methodology, relying solely on secondary data from existing academic literature and institutional reports. While this approach facilitates theoretical synthesis and interdisciplinary reflection, it lacks empirical grounding in real-world EdTech development practices. As a result, the study's conclusions—although insightful—remain hypothetical and may not fully capture the operational complexities faced by EdTech practitioners, educators, or curriculum designers.

Second, the absence of primary data collection—such as interviews with startup founders, educators, or education policymakers—limits the study's ability to contextualize innovation processes within specific institutional or cultural environments. This restricts the applicability of the proposed frameworks and may overlook critical factors such as regulatory dynamics, teacher agency, or regional disparities in EdTech adoption. *Third,* the study does not include comparative case studies of successful or failed EdTech ventures, which could offer valuable empirical validation for the proposed integration of design thinking, curriculum theory, and stakeholder co-creation. Without such case-based evidence, it is difficult to assess the feasibility and scalability of the innovation management strategies discussed. *Fourth,* the research does not sufficiently engage with the political economy of EdTech—particularly issues related to commercialization, data ethics, platform governance, and venture capital influence—which increasingly shape the trajectory of educational innovation. Addressing these macro-level forces is critical to understanding both the enablers and constraints of pedagogically grounded innovation in the EdTech sector.

Given these limitations, several directions are proposed for future research. *First*, empirical studies involving qualitative fieldwork, interviews, or ethnographic observation are needed to investigate how EdTech startups manage innovation in practice. Such studies should focus on the interaction between technological development, curriculum alignment, and teacher involvement. *Second,* cross-cultural comparative studies could provide insight into how local educational systems mediate the integration of EdTech solutions. Understanding how innovation management models perform across different regulatory, pedagogical, and infrastructural contexts will enhance the generalizability of theoretical frameworks.

Third, future research should analyze the institutional and policy conditions that facilitate or hinder meaningful educator participation in EdTech development. This includes investigating mechanisms for co-design, professional development incentives, and governance models that prioritize pedagogical expertise. *Fourth,* interdisciplinary research that draws from critical data studies, educational policy, and innovation theory could enrich the understanding of ethical, legal, and systemic dimensions of EdTech innovation. This would help address concerns about algorithmic bias, student privacy, and equitable access that are often underexplored in startup-centric innovation narratives.

Lastly, longitudinal studies are recommended to assess the long-term impact of EdTech interventions on curriculum transformation, learner outcomes, and teacher practices. Tracking these outcomes over time can help determine whether the proposed innovation frameworks yield sustainable and scalable benefits for education systems. By addressing these research gaps, future studies can contribute to the development of robust, evidence-based

models of EdTech innovation management that are both pedagogically responsive and socially responsible.

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