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Drivers of Adoption: How Innovation Attributes Influence the Diffusion of Digital Tools in Indonesia's Merdeka Curriculum

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Abstract

This study investigates the influence of innovation attributes on the diffusion of educational technology within Indonesia's Merdeka Curriculum using an explanatory sequential mixed-methods design. Quantitative analysis of 120 elementary teachers revealed that relative advantage and compatibility significantly promote technology adoption, while complexity hinders it. Qualitative findings from a subset of participants elucidate these results, identifying three key contextual drivers that shape the salience of these attributes: (1) institutional and peer support, which enhances perceived ease of use and trialability; (2) pedagogical relevance, which critically underpins perceptions of relative advantage and compatibility; and (3) socio-cultural adaptation, which emerged as a core component of perceived compatibility in this context. Teachers adopt digital tools such as Canva and augmented reality more readily when these tools are embedded within supportive structures and aligned with local pedagogical and cultural contexts. The study extends Rogers' Diffusion of Innovations theory by theorizing socio-cultural adaptation and institutional readiness not merely as external conditions, but as integral factors that dynamically shape educators' perceptions of core innovation attributes. Findings suggest that meaningful adoption requires not only access to technology but also continuous training, supportive school leadership, and culturally responsive practices to ensure sustainable innovation in primary education.

Keywords: Diffusion Of Innovation; Educational Technology; Merdeka Curriculum; Teacher Adoption; Cultural Adaptation; Explanatory Sequential Design; Indonesia.

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1. INTRODUCTION

The integration of digital technology into education has become a pivotal component of pedagogical transformation in the 21st century. Across the globe, digital learning tools are increasingly employed to foster creativity, collaboration, and critical thinking—skills that are indispensable for students' lifelong learning (UNESCO, 2024). In Indonesia, the government's Merdeka Curriculum (Kurikulum Merdeka) represents a strategic response to this transformation, promoting learner autonomy, flexibility, and contextualized learning practices (OECD, 2024). The curriculum seeks to shift educational culture from teacher-centered instruction toward a more inquiry-driven and competence-based model that encourages creativity and critical thinking (RGSA, 2023). In practice, these objectives are expected to be supported by digital platforms and innovative learning technologies that empower both teachers and students to learn actively and meaningfully.

In line with this national vision, the Ministry of Education, Culture, Research, and Technology has developed a comprehensive digital ecosystem, including the Platform Merdeka Mengajar, ARKAS, Rapor Pendidikan, and Guru Penggerak initiatives, aimed at facilitating digital learning and data-driven education (GovTech Edu, 2023). These platforms are part of Indonesia's long-term plan for irreversible educational digitalization, which aligns with the Education for Sustainable Development (ESD) framework (UNESCO, 2024). Despite this momentum, however, the diffusion and consistent use of educational technology in Indonesian schools remain uneven. Studies indicate that the success of technological integration varies widely depending on teachers' perceptions, school support systems, and contextual readiness (Sari et al., 2024). Infrastructure and policy, while critical, are insufficient without ensuring teachers' willingness and capability to adopt and sustain innovation in their classrooms (Wiratomo, 2025).

To understand the factors that shape technology adoption in schools, the Diffusion of Innovations theory proposed by Rogers (2003) offers an analytical framework widely applied in educational research. This theory identifies five key attributes that influence how and why an innovation is adopted: relative advantage, compatibility, complexity, trialability, and observability. In the context of education, these attributes can determine whether teachers perceive digital tools as effective, easy to use, aligned with curriculum needs, and visible in their outcomes. Numerous studies have confirmed the relevance of these attributes in explaining the variability of technology diffusion in schools. For instance, Learning Gate (2024) found that teachers' perception of relative advantage and compatibility strongly predicted the success of the Smart School policy in Indonesia. Similarly, Muslich (2023) demonstrated that complexity and lack of observability constrained the use of virtual reality (VR) tools in science classrooms. These findings affirm that innovation diffusion in education is not merely technical but also social and perceptual.

Other research has integrated Rogers' model with the Technology Acceptance Model (TAM) to explore emerging technologies such as generative artificial intelligence, demonstrating that perceived usefulness—closely related to relative advantage—remains a key determinant of adoption (Ghimire & Edwards, 2024). Meanwhile, Putra and Dewi (2022) showed that contextual factors such as school leadership and peer collaboration moderate the diffusion process, indicating that innovation adoption is

influenced not only by individual perception but also by institutional dynamics. However, most prior investigations have focused on higher education or online learning contexts, with limited attention to elementary education where teachers' pedagogical beliefs, local wisdom, and socio-cultural factors play crucial roles.

In Indonesia's primary schools, many studies have examined the effectiveness of educational media rather than the process of adoption. For instance, Aswandari et al. (2025) developed flashcards integrating local wisdom to improve mathematical understanding, while Yuliastuti and Mansur (2025) designed interactive learning media using Canva and augmented reality to strengthen social values in civic education. These studies confirmed that digital tools can enhance engagement and outcomes. Nevertheless, they rarely address why some teachers adopt such innovations enthusiastically while others remain reluctant. As noted by Maharani et al. (2025), innovation implementation often encounters resistance rooted in teachers' perceptions of relevance, complexity, and institutional support.

Given this gap, it is necessary to investigate the adoption of educational technology through the theoretical lens of innovation diffusion within the Merdeka Curriculum framework. Understanding how innovation attributes influence teachers' decision-making and classroom integration will not only enrich theoretical perspectives but also inform practical strategies for scaling educational technology more effectively. Therefore, this study aims to analyze the impact of the five innovation attributes—relative advantage, compatibility, complexity, trialability, and observability—on the diffusion of educational technology among Indonesian elementary school teachers implementing the Merdeka Curriculum. By addressing this issue, the study seeks to provide evidence-based insights for policymakers, school leaders, and teacher educators to design more culturally responsive and sustainable innovation strategies in the digital transformation of education.

2. LITERATURE REVIEW

2.1. Educational Technology in the Merdeka Curriculum

The Merdeka Curriculum (Independence Curriculum) introduced by Indonesia's Ministry of Education, Culture, Research, and Technology aims to strengthen learner-centered education through flexibility, contextualization, and project-based learning (OECD, 2024). Its implementation is closely tied to the digital transformation of learning systems, in which technology serves as both a medium and catalyst for pedagogical reform (GovTech Edu, 2023). Through platforms such as Merdeka Mengajar, ARKAS, and Rapor Pendidikan, teachers are encouraged to design differentiated and collaborative learning experiences that integrate digital tools (UNESCO, 2024).

Educational technology (EdTech) under the Merdeka Curriculum is not merely instrumental but also transformative—it facilitates learner autonomy and supports formative assessment aligned with Profil Pelajar Pancasila (the Pancasila Students' Profile) (RGSA, 2023). Research has shown that technology-enabled instruction can enhance students' higher-order thinking, motivation, and digital literacy (Sari et al., 2024; Aswandari et al., 2025). However, technology adoption remains inconsistent across schools due to

disparities in infrastructure, teacher readiness, and institutional culture (Maharani et al., 2025). Hence, understanding how teachers perceive technological innovation and integrate it into their practice becomes critical for realizing the goals of the Merdeka Curriculum.

2.2. Innovation Diffusion Theory in Education

Rogers' Diffusion of Innovations theory (2003) provides a well-established lens for analyzing technology adoption in educational contexts. The theory posits that five innovation attributes—relative advantage, compatibility, complexity, trialability, and observability—influence the rate and extent of adoption. Relative advantage refers to the degree to which an innovation is perceived as better than its predecessor; compatibility assesses its alignment with users' values and experiences; complexity represents the perceived difficulty of use; trialability measures the possibility of experimentation; and observability reflects the visibility of results.

These attributes have been widely applied in educational studies to explain teacher adoption behavior. For instance, Putra and Dewi (2022) found that relative advantage and compatibility were significant predictors of e-learning adoption among Indonesian teachers, whereas complexity served as a barrier. Likewise, Ghimire and Edwards (2024) identified that educators' willingness to use generative AI was strongly associated with perceived usefulness (analogous to relative advantage) and compatibility with their teaching goals. The diffusion process is not linear but mediated by social influence, leadership, and organizational support (Learning Gate, 2024). Therefore, in educational institutions, diffusion occurs within a socio-cultural ecosystem where peer collaboration and administrative endorsement accelerate adoption (Muslich, 2023).

2.3. Empirical Studies on Technology Adoption in Indonesian Schools

Empirical evidence from Indonesian contexts reinforces the complexity of technology diffusion in schools. Maharani et al. (2025) revealed that the success of innovation programs depends not only on technical readiness but also on educators' perception of institutional support and relevance. Similarly, Sari et al. (2024) found that digital literacy and teacher competence were crucial determinants of successful technology integration in primary classrooms.

Several studies have developed and tested specific learning media—such as Canva-based flipbooks, augmented reality modules, and interactive multimedia—to enhance engagement and learning outcomes (Yuliastuti & Mansur, 2025; Aswandari et al., 2025). These innovations have shown positive impacts, particularly in promoting contextual learning and creativity. However, most of these studies adopt a product-oriented or effectiveness evaluation approach, focusing on usability, validity, and student achievement rather than the adoption process itself (Utami et al., 2025).

Meanwhile, diffusion-focused research remains limited. Wiratomo (2025) examined distance learning adoption in open universities and found that teacher perceptions of complexity and observability significantly affected adoption rates. Learning Gate (2024) further emphasized the role of organizational climate and leadership support in shaping the diffusion trajectory of Indonesia's Smart School initiative.

Collectively, these studies underscore that innovation diffusion in education is context-dependent, shaped by pedagogical culture, perceived benefit, and institutional support.

2.4. Research Gap and Conceptual Framework

Despite the growing body of literature on educational technology and innovation diffusion, few studies have specifically investigated how Rogers' five attributes operate within the Merdeka Curriculum framework, particularly at the elementary level. Most existing research emphasizes secondary or higher education, where technological competence and resource availability differ significantly. In contrast, elementary teachers often face constraints in digital skills, pedagogical adaptation, and contextual integration, which influence their perception of technology's relevance and usability (Maharani et al., 2025; UNESCO, 2024).

Therefore, this study conceptualizes the diffusion of educational technology as a function of five key innovation attributes influencing teachers' adoption behaviors. Figure 1 (conceptualized in the next section) illustrates that relative advantage and compatibility are hypothesized to positively affect adoption, complexity to negatively affect it, while trialability and observability act as facilitating factors. Additionally, institutional support and socio-cultural alignment are considered moderating variables within the diffusion process. By situating this inquiry within the Merdeka Curriculum implementation, the study aims to generate both theoretical insights and practical implications for accelerating educational technology adoption in Indonesian elementary schools.

3. METHOD

3.1. Research Design

This study employed an explanatory sequential mixed-method design, combining quantitative and qualitative approaches to comprehensively examine the factors influencing the diffusion of educational technology within the Merdeka Curriculum framework. The quantitative phase was conducted first to identify significant predictors of technology adoption among elementary school teachers, followed by a qualitative phase to explore the contextual and perceptual dimensions underlying these quantitative findings. This design was chosen because it allows for statistical generalization while providing interpretive depth to explain why and how certain innovation attributes shape adoption behavior (Creswell & Plano Clark, 2018).

In the first phase, survey data were collected through structured questionnaires measuring teachers' perceptions of innovation attributes and their level of technology adoption. The second phase involved semi-structured interviews with selected teachers representing different adoption levels (high, moderate, and low), providing insights into social, institutional, and cultural influences on innovation diffusion. The integration of both datasets occurred at the interpretation stage, ensuring that quantitative patterns were substantiated and elaborated through qualitative narratives. Table 1 illustrates the overall design of the explanatory sequential mixed-method process applied in this study.

Table 1. Research Design Overview

Phase	Purpose	Data Collection	Participants	Data Analysis	Expected Outcome
Phase 1: Quantitative	Identify relationships between innovation attributes and technology adoption levels	Questionnaire (5-point Likert scale)	120 teachers	Multiple regression analysis	Determine significant predictors of adoption
Phase 2: Qualitative	Explore contextual and perceptual factors influencing adoption behavior	Semi-structured interviews	10 teachers	Thematic analysis (Braun & Clarke, 2019)	Deep understanding of teacher perspectives and institutional context
Integration	Merge and interpret findings from both phases	Narrative interpretation and triangulation	—	Mixed-method interpretation	Holistic model of educational technology diffusion

3.2. Participants

The participants consisted of 120 elementary school teachers from three regions in South Sumatra Province: Palembang, Prabumulih, and Indralaya. These regions were selected due to their diverse educational environments, ranging from urban to semi-rural contexts, which allowed for the exploration of variations in digital readiness and institutional support. A stratified random sampling technique was used to ensure representation across different school types (public and private) and grade levels (grades 1–6).

For the qualitative phase, a purposive sampling approach was employed to select 10 teachers based on their level of technology adoption identified from the quantitative results. The selection criteria reflected three adoption categories—high (top 25%), moderate (middle 50%), and low (bottom 25%)—to capture diverse perspectives. These participants provided rich descriptions of their experiences integrating digital tools such as Canva, Google Sites, Nearpod, and augmented reality (AR)-based media within their classroom practices. Ethical approval was obtained prior to data collection, and all participants provided informed consent.

3.3. Instruments

3.3.1. Questionnaire

The questionnaire used in this study was adapted from Rogers' (2003) Diffusion of Innovations framework and revised to fit the educational technology context of the Merdeka Curriculum. The instrument contained 25 items grouped into five subscales corresponding to innovation attributes: (a) Relative advantage (5 items), (b) Compatibility (5 items), (c) Complexity (5 items), (d) Trialability (5 items), and € Observability (5 items).

Each item was rated on a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Example items include: "Using digital platforms enhances my students' engagement" (relative

advantage), and "Integrating technology fits well with my current teaching style" (compatibility).

Prior to data collection, the questionnaire underwent content validation by three experts in educational technology and curriculum studies. A pilot test with 20 teachers was conducted to assess clarity, relevance, and internal consistency. The final instrument achieved a Cronbach's Alpha reliability coefficient of 0.87, indicating high internal reliability. Construct validity was further confirmed through exploratory factor analysis, which supported the five-factor model of innovation attributes.

3.3.2. Interview Guide

The semi-structured interview guide was designed to capture in-depth perspectives of teachers regarding the adoption process. Questions focused on three thematic areas:

- Teachers' personal experiences with digital media in the classroom,
- Perceived facilitators and barriers to adopting educational technology, and
- Institutional and leadership support during Merdeka Curriculum implementation.

Sample guiding questions included: "What motivated you to start using Canva or other digital tools in your lessons?", "What challenges did you encounter while integrating these tools?", and "How does your school leadership support innovation in teaching?" Each interview lasted approximately 45–60 minutes and was conducted either face-to-face or via video call, depending on participants' availability. The interviews were audio-recorded and transcribed verbatim for analysis.

3.4. Data Analysis

3.4.1. Quantitative Data Analysis

Quantitative data were analyzed using IBM SPSS Statistics version 28. Prior to analysis, data were screened for missing values, outliers, and normality assumptions. Descriptive statistics were first computed to summarize demographic information and mean scores for each innovation attribute.

To test the hypothesized relationships, a multiple regression analysis was performed with level of technology adoption as the dependent variable, operationalized through three indicators: (1) frequency of technology use, (2) self-efficacy in digital instruction, and (3) degree of integration into lesson design. The independent variables were the five innovation attributes: relative advantage, compatibility, complexity, trialability, and observability. The regression coefficients were interpreted to determine the magnitude and direction of influence for each attribute. A significance level of $p < .05$ was applied. The analysis results were later used to select participants for the qualitative phase based on their adoption levels.

3.4.2. Qualitative Data Analysis

The qualitative data were analyzed using thematic analysis following the six-phase approach proposed by Braun and Clarke (2019): (a) Familiarization with the data through repeated reading of transcripts, (b) Generating initial codes, (c) Searching for themes, (d) Reviewing themes, (e) Defining and naming themes, and (f) Producing the report.

The analysis was conducted manually and supported by NVivo 14 for efficient coding and retrieval. Emerging themes focused on teachers' motivational factors, institutional leadership, peer collaboration, and socio-cultural influences in adopting technology. Triangulation between quantitative and qualitative findings ensured credibility and consistency. Member checking was performed by sharing summaries with participants for validation.

The integration of quantitative and qualitative results was achieved through side-by-side comparison and joint display matrices, where statistical trends were contextualized with illustrative quotes. This mixed-method integration provided a holistic understanding of how innovation attributes affect technology diffusion in the Merdeka Curriculum environment.

4. RESULT AND DISCUSSION

4.1. Quantitative Findings

Prior to performing inferential analysis, data screening was conducted to ensure that the assumptions of multiple regression were met. Normality of residuals was confirmed using the Kolmogorov–Smirnov test ($p = 0.072$), while scatterplot analysis indicated the absence of heteroscedasticity. Variance Inflation Factor (VIF) values ranged between 1.12 and 1.83, suggesting no multicollinearity issues among predictor variables. Therefore, the dataset met the necessary statistical assumptions for regression analysis.

Descriptive analysis showed that the teachers demonstrated a moderately high perception toward innovation attributes, with the highest mean scores recorded for relative advantage ($M = 4.21$, $SD = 0.56$) and compatibility ($M = 4.05$, $SD = 0.62$). Conversely, complexity obtained a relatively lower mean ($M = 3.12$, $SD = 0.71$), indicating that some teachers still perceived technology use as challenging.

To test the main hypothesis, a multiple linear regression analysis was conducted to examine the influence of five innovation attributes—relative advantage, compatibility, complexity, trialability, and observability—on teachers' level of educational technology adoption. The dependent variable was operationalized as teachers' frequency of technology use, self-efficacy in integrating digital tools, and depth of integration into instructional design.

The overall regression model was statistically significant, $F(5,114) = 12.34$, $p < 0.001$, explaining 62% of the variance ($R^2 = 0.62$) in technology adoption levels. This indicates that the five innovation attributes collectively provide a strong explanatory power in predicting how teachers integrate educational technology within the Merdeka Curriculum.

Table 2. Results of Multiple Regression Analysis on Innovation Attributes Predicting Technology Adoption

Predictor Variable	Unstandardized B	SE B	Beta (β)	t-value	Sig. (p)	Interpretation
Relative Advantage	0.417	0.119	0.38	3.50	0.001	Strong positive influence
Compatibility	0.298	0.102	0.29	2.93	0.004	Moderate positive influence

Complexity	-0.273	1.07	-0.25	-2.57	0.012	Significant negative influence
Trialability	0.176	0.091	0.18	1.92	0.056	Weak positive (marginal)
Observability	0.142	0.078	0.15	1.80	0.072	Non-significant positive tendency

Model Summary: $R^2 = 0.62$, Adjusted $R^2 = 0.60$, $F(5,114) = 12.34$, $p < 0.001$

The regression results demonstrate that relative advantage emerged as the strongest and most significant predictor of technology adoption ($\beta = 0.38$, $p = 0.001$). This finding indicates that teachers who perceive educational technology as providing greater pedagogical benefits—such as increased student engagement and improved learning outcomes—are more likely to integrate it into classroom practices. Similarly, compatibility also exhibited a significant positive effect ($\beta = 0.29$, $p = 0.004$), implying that when technology aligns with existing teaching methods and curricular goals, adoption becomes more feasible and sustainable.

Conversely, complexity negatively predicted adoption ($\beta = -0.25$, $p = 0.012$), suggesting that teachers who find technology difficult to use or time-consuming are less inclined to adopt it. This aligns with Rogers' (2003) assertion that perceived complexity inhibits innovation diffusion, particularly in environments with limited technical support. The variables trialability ($\beta = 0.18$, $p = 0.056$) and observability ($\beta = 0.15$, $p = 0.072$) showed weak or non-significant influences. Although both exhibited positive tendencies, their effects were marginal, indicating that opportunities to experiment with new technologies and observe others using them did not substantially drive adoption within this sample.

Overall, these results reveal that perceived benefit and curricular alignment are the two most crucial determinants of technology diffusion in the Merdeka Curriculum era. Teachers' willingness to integrate educational technology is primarily influenced by how well it complements their instructional practices and whether it clearly demonstrates added pedagogical value. Meanwhile, the negative impact of complexity underscores the continuing need for professional development and technical mentoring to reduce barriers and enhance teachers' confidence in utilizing digital tools.

4.2. Qualitative Findings

The qualitative phase sought to deepen the understanding of teachers' experiences and contextual factors influencing the adoption of educational technology within the Merdeka Curriculum. Using the thematic analysis approach proposed by Braun and Clarke (2019), three dominant themes were identified from the interviews: (1) institutional and peer support, (2) perceived pedagogical relevance, and (3) socio-cultural adaptation. Each theme is elaborated below with supporting statements from participants (pseudonyms are used to ensure anonymity).

Theme 1: Institutional and Peer Support

One of the strongest patterns emerging from the data was the critical role of institutional and peer support in fostering technology diffusion. Teachers consistently emphasized that school leadership

commitment, peer collaboration, and continuous mentoring from ICT teams or Guru Penggerak programs were key enabling factors in sustaining innovation.

Several participants reported that schools with regular workshops and mentoring sessions were more successful in embedding digital learning practices. For example, a teacher from Palembang stated:

> *"Our principal provides regular sessions on using Canva and Google Sites. Because of that, most of us now feel confident integrating them into lesson plans." (T3)*

Similarly, peer influence played a substantial role. Teachers often learned digital tools informally through colleagues who had prior experience or stronger digital literacy. A participant from Indralaya explained:

> *"I was hesitant at first, but after observing my colleague use interactive quizzes in class, I realized it wasn't that hard. We started sharing templates and supporting each other." (T7)*

This finding suggests that innovation diffusion occurs through social learning, aligning with Rogers' (2003) notion that interpersonal communication and local opinion leaders accelerate adoption. The data also highlight that teachers' confidence is reinforced by administrative encouragement, such as recognition programs or inclusion of digital innovation in school performance evaluations. In contrast, teachers in schools lacking formal ICT support tended to rely on self-learning, resulting in slower diffusion.

Theme 2: Perceived Pedagogical Relevance

A second major theme was the alignment between technology use and pedagogical goals. Teachers expressed that they were more motivated to adopt new technologies when they perceived a clear connection between digital tools and the intended learning outcomes, particularly in promoting Profil Pelajar Pancasila attributes such as creativity, collaboration, and moral values.

As one teacher described:

> *"Using Canva helps me design materials that relate directly to the character values in the Merdeka Curriculum—like cooperation, independence, and tolerance." (T2)*

Many participants reported that they preferred platforms such as Canva, Nearpod, and AR-based applications because these tools allowed them to visualize abstract concepts and engage students in

interactive learning. For example, AR applications were found useful in science lessons, where students could observe 3D models of plant anatomy or solar systems, making the learning process more concrete.

Teachers also emphasized that the Merdeka Curriculum encourages them to create contextualized and student-centered learning, which made digital tools an appealing choice. However, they were selective: tools perceived as too generic or irrelevant to lesson goals were rarely adopted. Thus, pedagogical relevance acted as a filter determining which innovations were sustained in classroom practices.

This finding aligns with the quantitative result showing that compatibility was a significant predictor of adoption. Teachers adopted digital media not merely because of novelty but because they could see its practical benefits for learning engagement and formative assessment.

Theme 3: Socio-Cultural Adaptation

The third theme underscored the importance of socio-cultural factors in mediating the diffusion of educational technology. Teachers found that technology integration was more effective when digital media incorporated elements of local culture, values, and community context.

For instance, teachers in rural schools often adapted materials by embedding local wisdom (kearifan lokal) such as folklore, traditional songs, or regional symbols into digital media. A teacher from Prabumulih shared:

> *"Students get excited when they see familiar stories in our digital lessons—like the legend of Kemaro Island or local dances. It makes learning more meaningful for them." (T9)*

This approach not only increased student engagement but also enhanced teachers' sense of cultural ownership and authenticity in implementing the Merdeka Curriculum. The theme also reflects a broader pedagogical trend emphasizing culturally responsive teaching, where learning tools are contextualized to students' socio-cultural backgrounds.

However, several participants noted challenges in accessing digital resources that represent local content. Teachers frequently had to create their own materials due to the lack of localized templates. Despite these constraints, the incorporation of local identity into digital lessons appeared to smoothen the diffusion process, as teachers felt the innovation aligned more naturally with both curriculum goals and community values.

4.3. Discussion

4.3.1. Reinforcing Rogers' Diffusion Theory in the Merdeka Curriculum Context

The present study reaffirms Rogers' (2003) Diffusion of Innovations theory, which posits that five core innovation attributes—relative advantage, compatibility, complexity, trialability, and observability—

determine the rate of adoption. In the context of Indonesia's Merdeka Curriculum, the quantitative findings highlight that teachers' perceptions of relative advantage and compatibility were the most powerful predictors of technology adoption, while complexity exerted a significant negative effect. These results underscore that teachers are more likely to integrate educational technology when they perceive clear pedagogical benefits (relative advantage) and when the technology aligns with their instructional goals and existing teaching practices (compatibility).

This finding aligns with recent studies indicating that perceived usefulness and pedagogical fit remain the strongest determinants of educational technology adoption (Ghimire & Edwards, 2024; Feng et al., 2025). For instance, Ghimire and Edwards (2024) found that educators' decisions to adopt generative AI tools were primarily driven by their perceived instructional relevance rather than novelty. Similarly, Putra and Dewi (2022) reported that the adoption of e-learning tools among Indonesian teachers increased when those tools were consistent with curriculum standards and teaching methods.

Conversely, complexity was found to negatively influence adoption ($\beta = -0.25$, $p = 0.012$). Teachers who perceived technology as difficult to use, time-consuming, or technically demanding were less inclined to integrate it into their practice. This supports prior research indicating that perceived ease of use and simplicity are essential for sustainable innovation diffusion (Feng et al., 2025). Complexity is particularly salient in developing-country contexts, where teachers may face infrastructural constraints, limited ICT literacy, and inconsistent institutional support (Faiz et al., 2024; OECD, 2024).

Meanwhile, trialability ($\beta = 0.18$, $p = 0.056$) and observability ($\beta = 0.15$, $p = 0.072$) showed weak or non-significant effects. Although both exhibited positive trends, the lack of significance suggests that teachers had limited opportunities to experiment with new technologies or observe successful examples in their schools. This finding resonates with Faiz et al. (2024), who emphasized that the visibility of technology use and demonstration opportunities significantly enhance diffusion, but remain underdeveloped in many Indonesian schools. Therefore, while Rogers' model remains theoretically sound, these findings suggest that contextual and organizational factors must be considered to understand the diffusion of innovation in real-world educational systems (Robinson, 2025).

4.3.2. Insights from Qualitative Findings

The qualitative phase provided deeper explanations for the quantitative results, revealing how innovation attributes interact with social, pedagogical, and cultural contexts in shaping adoption behaviors.

(a) Institutional and Peer Support as Catalysts for Diffusion

Institutional support emerged as a decisive enabler of technology adoption. Teachers emphasized that consistent mentoring, leadership encouragement, and peer collaboration significantly facilitated their willingness to integrate digital tools. Schools that organized regular training sessions and provided ICT mentors demonstrated higher levels of adoption. This finding corroborates Rogers' (2003) notion that interpersonal communication channels and "change agents" accelerate the diffusion process.

Teachers also highlighted the role of peer modeling, where early adopters served as informal mentors for others. This social learning dynamic mirrors findings from Basister et al. (2025), who observed that collaborative professional communities—such as lesson study groups—enhance teachers' innovation confidence and reduce perceived complexity. Similarly, Ning and Danso (2025) emphasized that continuous pedagogical training and supportive institutional culture are critical for fostering digital innovation readiness among teachers. Therefore, diffusion is not merely a function of individual perception but a collective process nurtured by institutional ecosystems.

(b) Perceived Pedagogical Relevance as a Central Filter

The second emergent theme, perceived pedagogical relevance, highlights teachers' selective approach to technology use. Teachers adopt tools that are pedagogically meaningful and directly contribute to learning outcomes aligned with Profil Pelajar Pancasila—the Indonesian framework promoting character development, collaboration, and critical thinking.

Teachers consistently reported that tools like Canva, Nearpod, and AR-based media were preferred because they enhanced student engagement and allowed for creative, contextualized learning. This mirrors prior studies showing that technologies perceived as pedagogically valuable are more likely to be sustained in classroom practice (Feng et al., 2025). In contrast, technologies lacking clear instructional relevance were viewed as distractions. These findings reinforce the quantitative evidence that compatibility and relative advantage are key adoption drivers.

Perceived pedagogical relevance also acts as a sense-making mechanism: teachers rationalize innovation based on how it supports their instructional philosophy and curriculum priorities. As Ghimire and Edwards (2024) observed, adoption is less about technological curiosity and more about pedagogical purpose—a finding echoed in this study.

(c) Socio-Cultural Adaptation as a Legitimizing Strategy

The third theme—socio-cultural adaptation—illustrates that the adoption of educational technology is most successful when innovations are contextualized within local cultural frameworks. Teachers reported that embedding local wisdom (kearifan lokal), folklore, or regional symbols into digital media significantly enhanced student engagement and ownership of learning. For example, teachers integrating local legends or traditional values into digital storytelling observed stronger emotional and cognitive connections among students.

This finding aligns with culturally responsive teaching frameworks, which advocate for connecting pedagogy with learners' cultural identities to increase relevance and motivation (Basister et al., 2025). It also resonates with Muslich (2023), who noted that social construction processes—where communities co-create the meaning of technology—are critical for sustainable adoption. Nevertheless, teachers also cited challenges, such as the lack of localized digital resources, requiring them to create their own content. This

suggests that policymakers and educational media developers should prioritize developing culturally grounded digital materials that enhance both engagement and diffusion.

4.3.3. Integration of Quantitative and Qualitative Findings

Integrating both strands of findings offers a holistic understanding of the diffusion of educational technology within the Merdeka Curriculum. Quantitative data identified relative advantage, compatibility, and complexity as primary predictors of adoption, while qualitative data illuminated the mechanisms that explain these relationships—namely, the presence of institutional support, perceived pedagogical fit, and socio-cultural alignment.

The findings suggest that diffusion is not a linear process, but a dynamic interaction between technological, organizational, and cultural systems. Teachers' decisions to adopt or reject innovations are shaped by both individual cognition and collective environments. Trialability and observability, though statistically weak, may gain influence when institutional structures provide demonstration platforms and pilot programs.

These insights support the proposition by Robinson (2025) that traditional diffusion theory should evolve into an actor–system framework, integrating organizational learning, leadership, and cultural variables to explain innovation in complex education systems. The evidence from this study thus contributes to refining Rogers' framework by embedding it within the socio-cultural realities of developing education systems.

5. CONCLUSION

This study examined how innovation attributes influence the diffusion of educational technology in Indonesia's Merdeka Curriculum. The results revealed that relative advantage and compatibility were the strongest predictors of teachers' adoption of digital tools, while complexity acted as a significant barrier. These findings indicate that teachers are more willing to use technology when it clearly supports their teaching goals and aligns with existing practices. Conversely, when tools are perceived as difficult to use, adoption slows down. The study confirms Rogers' (2003) Diffusion of Innovations theory while emphasizing that educational reform success also depends on institutional and cultural factors beyond individual perceptions.

Qualitative findings enriched the quantitative results by highlighting three key contextual themes: institutional and peer support, pedagogical relevance, and socio-cultural adaptation. Teachers who received consistent training and mentoring were more confident in experimenting with new technologies. They preferred digital tools such as Canva and augmented reality when these could be directly linked to learning outcomes and Profil Pelajar Pancasila values. Moreover, adoption became smoother when media incorporated local wisdom, such as folklore or cultural symbols, making digital learning more meaningful and culturally resonant for students.

Based on these findings, several practical recommendations are proposed. Policymakers should provide continuous, hands-on professional development that helps teachers integrate technology meaningfully into lessons while reducing perceived complexity. School leaders should build a collaborative culture that encourages peer learning and innovation sharing. Educational media developers should design localized and culturally relevant content to make digital learning more engaging and inclusive. Lastly, researchers should extend this study through longitudinal designs to observe changes in technology adoption over time and assess the long-term effects on student learning.

Although the study provides valuable insights, it has several limitations. The research was limited to three regions in South Sumatra, which may not fully represent Indonesia's diverse educational landscape. It also relied on self-reported data, which may include bias, and used a cross-sectional design that captures only a single point in time. Future studies should involve a wider range of participants, include classroom observations or digital analytics for validation, and examine how school leadership and cultural factors interact with innovation attributes. In conclusion, the diffusion of educational technology in the Merdeka Curriculum will succeed only when innovation is pedagogically relevant, institutionally supported, and culturally grounded.

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