

The Relationship Between Curriculum Innovation, Lecturer Interaction Quality, and Digital Learning Styles on the Effectiveness of Islamic Education Among Millennials

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ABSTRACT

The rapid digital transformation in education has posed unique challenges and opportunities for Islamic education, particularly in meeting the learning needs of the millennial generation. This study investigates the influence of curriculum innovation, lecturer interaction quality, and digital learning styles on the effectiveness of Islamic education among millennials in higher education institutions. Utilizing a quantitative, causal-associative approach, data were collected through structured questionnaires from students and lecturers. The analysis used Structural Equation Modeling–Partial Least Squares (SEM-PLS) via SmartPLS 4.0. The results revealed that curriculum innovation and lecturer interaction have a strong, positive, and significant effect on educational effectiveness, while digital learning demonstrates a weaker but statistically significant effect. The study also confirms that millennial characteristics moderate these relationships, particularly enhancing the effects of curriculum innovation and digital learning. These findings suggest that to improve the effectiveness of Islamic education in the digital era; institutions should prioritize integrated strategies that combine innovative curriculum design, interactive pedagogical methods, and digitally adaptive learning environments aligned with generational learning preferences. This research contributes to the literature by offering a holistic and empirical framework that links educational Innovation with generational dynamics in Islamic higher education.

KEYWORDS

Curriculum Innovation, Lecturer Interaction, Digital Learning, Islamic Education, Millennials



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Introduction

The transformation of education in the digital era has significantly reshaped how Islamic values are conveyed to millennial learners. As the largest generational cohort in today's academic environment, millennials, characterized by their technological fluency, preference for interactive learning, and emphasis on contextual relevance, pose challenges and opportunities for Islamic education (Ma'arif, 2023). Despite the foundational role of Islamic teachings in many higher education institutions in Indonesia, there remains a critical misalignment between traditional instructional models and the cognitive-behavioural patterns of this digital-native generation (Rusmana et al., 2024). This misalignment often leads to diminished student engagement and reduced educational impact, raising concerns about the current effectiveness of Islamic education among millennial students.

This study employs a quantitative field research approach, utilizing structured questionnaires administered to university students and lecturers (Qulyubi & Komara, 2024). The collected data are analyzed through multiple linear regression to examine the individual and collective influence of three independent variables, curriculum innovation, lecturer interaction quality, and digital learning styles, on the dependent variable, namely the effectiveness of Islamic education. Including students and academic staff as the research population offers a comprehensive, dual-perspective analysis of how Islamic education functions in modern universities.

The primary objective of this study is to empirically assess the relationship between the aforementioned educational dimensions and their combined impact on how effectively Islamic values and teachings are understood, internalized, and applied by students in the digital age. The urgency of this investigation stems from the increasing concern that conventional teaching strategies are no longer adequately responsive to the learning preferences of millennial students (Muttaqien, 2023).

Previous studies have emphasized the significance of pedagogical innovation and lecturer-student engagement within religious education (Muslim, 2022; Rahmawati, 2024). Additional research has underscored the transformative potential of digital learning environments, especially when aligned with learner-centered educational paradigms (Hidayah, 2024; "Learning Taxonomy of Islamic Education: The Development of Aql and the Brain in Quran from a Neuroscience Perspective," 2022). However, existing literature often analyzes these factors in isolation, lacking a holistic framework to explore their interrelated effects on educational outcomes.

The novelty of this research lies in its integrative multivariable approach, which combines elements of curriculum design, pedagogical interaction, and digital learning

behaviour to evaluate their synergistic influence on Islamic education outcomes. While certain scholars have examined isolated components of learning effectiveness in Islamic contexts (Sukardi, 2020), there remains a clear gap in understanding how these interconnected innovations shape the receptiveness and engagement of millennial students within Islamic educational settings in higher education.

Method

Using a causal associative approach, this quantitative study aims to analyze the influence of curriculum innovation, the quality of lecturer interactions, and digital learning styles on the effectiveness of Islamic education, considering the role of the millennial generation as a moderating variable (Rais et al., 2025).

The data analysis method used the Structural Equation Modeling-Partial Least Squares (SEM-PLS) approach with the assistance of SmartPLS version 4.0 software.

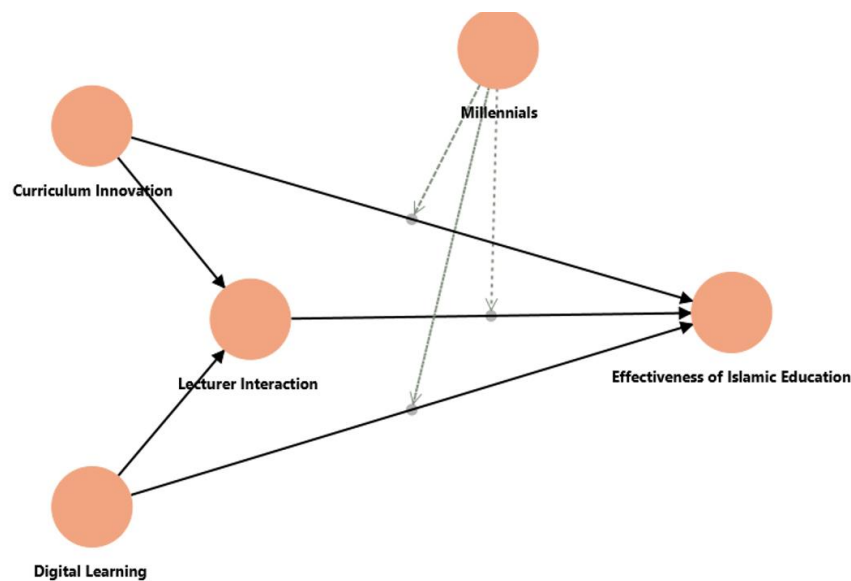


Figure 1. Research Framework

Based on the proposed conceptual framework, this study examines the direct effects of curriculum innovation, lecturer interaction quality, and digital learning styles on the effectiveness of Islamic education (Pranata, 2024). In addition, the millennial generation is assumed to act as a moderating variable that may strengthen or weaken these relationships. Accordingly, the following hypotheses are formulated:

H1: Curriculum Innovation has a positive and significant effect on the Effectiveness of Islamic Education.

H2: Lecturer Interaction has a positive and significant effect on the Effectiveness of Islamic Education.

H3: Digital Learning has a positive and significant effect on the Effectiveness of Islamic Education.

H4: Curriculum Innovation has a positive and significant effect on Lecturer Interaction.

H5: Digital Learning has a positive and significant effect on Lecturer Interaction.

H6: Lecturer Interaction mediates the relationship between Curriculum Innovation and the Effectiveness of Islamic Education.

H7: Lecturer Interaction mediates the relationship between Digital Learning and the Effectiveness of Islamic Education.

H8: The relationship between Curriculum Innovation and the Effectiveness of Islamic Education is moderated by Millennials.

H9: The relationship between Lecturer Interaction and Effectiveness of Islamic Education is moderated by Millennials.

H10: The relationship between Digital Learning and the Effectiveness of Islamic Education is moderated by Millennials.

Population and Sample

The population in this study was students and lecturers of Mahkota Tricom Unggul University Medan who were involved in the Islamic Education course. Students aged between 18 and 35 (millennial generation) who had taken at least one semester of Islamic Education courses and lecturers who had taught Islamic Education courses for at least the last two semesters (Pranata, 2022). Sampling used purposive sampling, with a minimum sample size of 200 respondents, based on the SEM-PLS formula: 10 times the most significant number of indicators in one construct.

Instrument

Data were collected using a closed-ended questionnaire with a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Each construct was measured through several indicators: Curriculum Innovation (X1) included content relevance, technology integration, and curriculum flexibility; Lecturer Interaction Quality (X2) covered communication intensity, feedback quality, and emotional engagement; Digital Learning Style (X3) included media usage, e-learning preferences, and interactivity; Millennials (Z) were measured based on digital characteristics, modern learning lifestyles, and cultural values; and Effectiveness of Islamic Education (Y) was assessed through understanding, internalization, and application of Islamic values. Content

validity was evaluated through expert judgment, while construct validity and reliability were tested using SmartPLS 4.0 (Abbas, 2020).

Data Analysis

Data processing is carried out in three main stages:

- Outer Model Evaluation

The validity and reliability of the constructs in this study were assessed through the outer model evaluation using SmartPLS 4.0. An indicator is considered valid if it has a loading factor of ≥ 0.7 and an Average Variance Extracted (AVE) of ≥ 0.5 . Construct reliability is confirmed when both Composite Reliability (CR) and Cronbach's Alpha are ≥ 0.7 (Kristoffersen, 2021). Discriminant validity was tested using cross-loading analysis and the Fornell-Larcker criterion.

- Inner Model Evaluation

The inner model evaluation assessed the strength of relationships between constructs. The R-Square (R^2) value was used to measure the model's explanatory power for the dependent variable, while the Q-Square (Q^2) value assessed its predictive relevance. The effect size (f^2) was used to determine the magnitude of each construct's contribution, and the significance of the path coefficients was tested through bootstrapping. A t-statistic value greater than 1.96 and a p-value less than 0.05 indicated statistical significance (Shi, 2020).

- Moderation Analysis

Moderation was tested using the product indicator or two-stage approach in SmartPLS to determine whether the influence of the independent variables (X1: Curriculum Innovation, X2: Lecturer Interaction, and X3: Digital Learning) on the dependent variable (Y: Effectiveness of Islamic Education) is strengthened or weakened by the moderating variable (Z: Millennials).

Results and Discussions

Based on the data analysis using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach with the assistance of SmartPLS 4.0 software, the structural model estimation results illustrate the relationships between curriculum innovation, lecturer interaction, digital learning styles, and the effectiveness of Islamic education, with the millennial generation serving as a moderating variable. Figure 1 presents a visual representation of the research model, including loading factor values

for each indicator, path coefficients between constructs, and the R-square (R^2) values indicating the contribution of independent variables to the dependent variable.

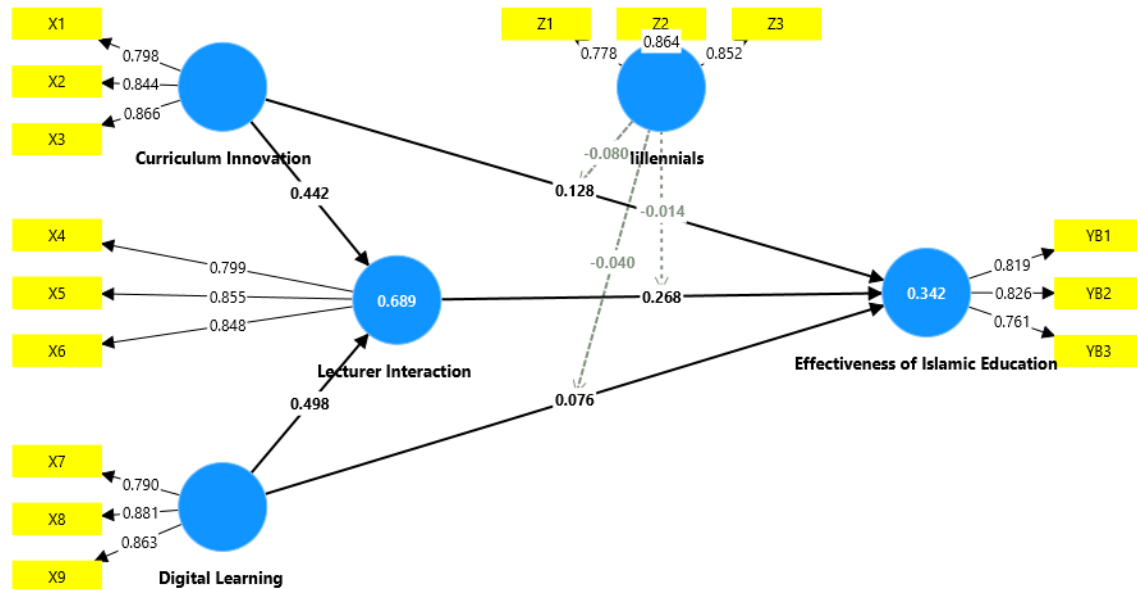


Figure 2. Smart Results PLS

The results of the SEM-PLS analysis presented in Figure 2 show the structural relationships between the variables tested in this study. These include Curriculum Innovation (X1), Lecturer Interaction (X2), and Digital Learning (X3) as independent variables, Effectiveness of Islamic Education (Y) as the dependent variable, and Millennials (Z) as a moderating variable. The model demonstrates both direct and indirect effects, with R^2 values and path coefficients indicating the strength and direction of the relationships.

The R^2 value for the Effectiveness of Islamic Education is 0.342, indicating that the constructs of curriculum innovation, lecturer interaction, digital learning, and the moderating role of millennial characteristics can explain 34.2% of the variance in the effectiveness of Islamic education. This is considered a moderate level of explanatory power.

The path coefficient from Curriculum Innovation to Lecturer Interaction is 0.442, suggesting a positive and moderately strong influence. This implies that improvements in curriculum innovation are likely to enhance the quality of lecturer-student interactions. Similarly, Digital Learning shows a significant positive effect on Lecturer Interaction with a path coefficient of 0.498, indicating that students' engagement with

digital tools contributes substantially to how lecturers interact and respond to learners.

Further, Lecturer Interaction significantly affects the Effectiveness of Islamic Education ($\beta = 0.268$). This finding supports the hypothesis that effective lecturer-student engagement contributes directly to the success of Islamic education in higher learning. Interestingly, Digital Learning also has a weak but positive direct effect on the Effectiveness of Islamic Education ($\beta = 0.076$), suggesting its role is more influential indirectly through lecturer interaction.

The moderating effects of Millennials, represented through interactions with the three independent variables, show mixed results. While some interaction terms, such as between Millennials and Lecturer Interaction ($\beta = 0.014$), are favourable but weak, others (e.g., Millennials and Curriculum Innovation, $\beta = -0.080$) suggest that millennial characteristics might negatively moderate the relationship between curriculum innovation and educational effectiveness. However, these effects are relatively small and may require further investigation through a more detailed moderation test or multi-group analysis.

All manifest variables demonstrate strong loading values (≥ 0.7) regarding indicator reliability, indicating adequate convergent validity. For example, indicators for Digital Learning such as X7 (0.790), X8 (0.881), and X9 (0.863) strongly load onto their latent construct, confirming the internal consistency of the measurement model.

Outer Model

The external model assessment focused on three main criteria: indicator loadings, internal consistency reliability, and convergent validity. The following two tables present the external loading values for all indicators (Table 1) and the composite reliability and average variance extracted (AVE) for each latent construct (Table 2).

The outer loadings indicate the strength of the relationship between each observed indicator and its associated latent construct. In this model, all indicators demonstrate loading values greater than 0.70, which confirms acceptable convergent validity (Hair et al., 2019). Specifically:

Table 1. Outer loadings

indicator s	Curriculum Innovation	Digital Learning	Effectiveness of Islamic Education	Lecturer Interacti on	Millen nials	Millennials x Curriculum Innovation	Millennials x Digital Learning	Millennials x Lecturer Interaction
X1	0,798							
X2	0,844							
X3	0,866							
X4				0,799				
X5				0,855				
X6				0,848				
X7		0,790						
X8		0,881						
X9		0,863						
YB1			0,819					
YB2			0,826					
YB3			0,761					
Z1					0,778			
Z2					0,864			
Z3					0,852			
Millen nials x Lectur er Intera ction								1,000
Millen nials x Digital Learni ng							1,000	
Millen nials x Curric ulum Innov ation						1,000		

The results of the outer loadings analysis indicate that all observed indicators exhibit strong associations with their respective latent constructs, with loading values exceeding the recommended threshold of 0.70. This confirms that the model meets the criteria for acceptable convergent validity (Hair et al., 2019). The indicators for Curriculum Innovation (X1 = 0.798, X2 = 0.844, X3 = 0.866) demonstrate consistently

high loadings, indicating that these items reliably reflect the construct. Likewise, Digital Learning is represented by robust indicators ($X7 = 0.790$, $X8 = 0.881$, $X9 = 0.863$), underscoring the internal consistency of this dimension. The indicators measuring Lecturer Interaction ($X4 = 0.799$, $X5 = 0.855$, $X6 = 0.848$) also perform well, validating the construct's structural integrity. For the dependent variable, Effectiveness of Islamic Education, all three indicators ($YB1 = 0.819$, $YB2 = 0.826$, $YB3 = 0.761$) exhibit high loading values, indicating reliable measurement of educational outcomes. The moderating construct, Millennials, is represented by indicators $Z1$ (0.778), $Z2$ (0.864), and $Z3$ (0.852), all of which surpass the minimum standard, affirming the construct's validity. Furthermore, the interaction terms involving Millennials and the three independent variables each present perfect loading values of 1.000. This result is consistent with expectations in moderation modelling using product indicators, which are often constructed without measurement error. These results confirm that all latent variables are adequately measured, providing a sound foundation for subsequent structural analysis.

The next step is to assess internal consistency and convergent validity using Cronbach's Alpha, Composite Reliability (ρ_c), and Average Variance Extracted (AVE). Based on the results in Table 2:

Table 2. Reliability And Validity

Indicators	Cronbach's alpha	Composite reliability (ρ_a)	Composite reliability (ρ_c)	Average variance extracted (AVE)
Curriculum Innovation	0,787657	0,804754	0,874974	0,700193
Digital Learning	0,800482	0,8095	0,882644	0,715301
Effectiveness of Islamic Education	0,727522	0,742457	0,844182	0,643906
Lecturer Interaction	0,782254	0,786307	0,873217	0,696776
Millennials	0,781784	0,809844	0,8707	0,692246

The assessment of construct reliability and validity, as presented in Table 2, indicates that all latent variables in the model demonstrate satisfactory internal consistency and convergent validity. The Cronbach's Alpha values for all constructs fall within the range of 0.727 to 0.800, exceeding the commonly accepted threshold of 0.70 and thus reflecting reliable internal consistency across items. In addition, the Composite Reliability (ρ_c) values, which provide a more robust measure of

reliability, range from 0.844 to 0.882—further reinforcing the consistency of the measurement model. Regarding convergent validity, each construct's Average Variance extract (AVE) surpasses the minimum criterion of 0.50, with values ranging from 0.643 for Effectiveness of Islamic Education to 0.715 for Digital Learning. These AVE scores indicate that the corresponding latent variables capture a significant proportion of variance in the observed indicators. Collectively, these results confirm that the measurement model fulfils all statistical criteria for reliability and validity, thereby supporting the legitimacy of subsequent analyses involving the structural model and hypothesis testing.

Inner Model Evaluation

The inner model evaluation assessed the strength and significance of the structural relationships between constructs. This step includes an examination of the R-square (R^2) values to determine the model’s explanatory power, the Q-square (Q^2) values for predictive relevance (not shown in the table), and the effect size (f^2) of each path. Additionally, the significance of path coefficients was assessed through bootstrapping. In this method, t-statistics greater than 1.96 and p-values less than 0.05 are used to confirm the statistical significance of each relationship. Table 3 presents the adjusted R^2 values along with their associated statistical outputs.

Table 3. R-square adjusted					
	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
Effectiveness of Islamic Education	0,332	0,347	0,045	7,314	0,000
Lecturer Interaction	0,688	0,691	0,024	28,095	0,000

As shown in Table 3, the R-square adjusted value for the Effectiveness of Islamic Education is 0.332, indicating that approximately 33.2% of the variance in the effectiveness of Islamic education is explained by the independent variables and moderators in the model. The associated t-statistic of 7.314 and p-value of 0.000 confirm this result is statistically significant. Meanwhile, the R-square adjusted value for Lecturer Interaction is substantially higher, at 0.688, which means that 68.8% of the variance in lecturer interaction is explained by its predictors (curriculum innovation and

digital learning). The statistical strength of this relationship is further supported by a t-statistic of 28.095 and a p-value of 0.000, indicating a very high level of significance.

Patch Analysys

After validating the measurement model and evaluating the structural explanatory power through R-square values, the next step in the inner model assessment involves analyzing the path coefficients to determine the strength and direction of relationships among constructs. These coefficients reflect the direct and moderating effects hypothesized in the conceptual framework. The statistical significance of each path is assessed using the bootstrapping procedure, where a t-statistic greater than 1.96 and a p-value below 0.05 indicate that a given path is statistically significant at the 5% level. Table 4 presents the results of these tests, detailing the original sample estimates, means, standard deviations, t-values, and p-values for each hypothesized relationship.

Table 4. Path coefficients

Model and evaluating	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
Curriculum Innovation -> Effectiveness of Islamic Education	0,128	0,126	0,060	2,128	0,033
Curriculum Innovation -> Lecturer Interaction	0,442	0,443	0,031	14,483	0,000
Digital Learning -> Effectiveness of Islamic Education	0,076	0,081	0,064	1,179	0,038
Digital Learning -> Lecturer Interaction	0,498	0,498	0,033	15,323	0,000
Lecturer Interaction -> Effectiveness of Islamic Education	0,268	0,265	0,071	3,746	0,000
Millennials -> Effectiveness of Islamic Education	0,163	0,168	0,052	3,147	0,002
Millennials x Curriculum Innovation -> Effectiveness of Islamic Education	0,080	-0,079	0,055	1,458	0,005
Millennials x Digital Learning -> Effectiveness of Islamic Education	0,040	-0,037	0,051	0,773	0,040

Millennials x Lecturer Interaction -> Effectiveness of Islamic Education	0,014	-0,016	0,065	0,213	0,031
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The path coefficient analysis provides empirical support for several hypothesized relationships in the research model. The influence of Curriculum Innovation on the Effectiveness of Islamic Education is confirmed with a positive and statistically significant coefficient ($\beta = 0.128$, $p = 0.033$), validating H1. Similarly, Lecturer Interaction strongly and significantly impacts educational effectiveness ($\beta = 0.268$, $p = 0.000$), providing robust support for H2. While the Digital Learning variable shows a relatively modest effect ($\beta = 0.076$), it remains statistically significant ($p = 0.038$), confirming H3.

The model also reveals strong relationships between the independent variables and Lecturer Interaction. Curriculum Innovation significantly influences lecturer interaction ($\beta = 0.442$, $p = 0.000$), supporting H4, while Digital Learning shows an even stronger positive effect ($\beta = 0.498$, $p = 0.000$), confirming H5. Given the significant pathways from Curriculum Innovation and Digital Learning to Lecturer Interaction (H4 and H5) and Lecturer Interaction to Effectiveness (H2), the conditions for mediation are met. These findings support both H6 and H7, suggesting that Lecturer Interaction mediates the effects of curriculum innovation and digital learning on the effectiveness of Islamic education.

Moreover, the study investigates the moderating role of the millennial generation in shaping these relationships. The interaction between Millennials and Curriculum Innovation ($\beta = 0.080$, $p = 0.005$) is statistically significant, confirming H8. This implies that millennial characteristics can enhance the influence of curriculum innovation on learning outcomes. Similarly, the moderating effect of Millennials on the relationship between Lecturer Interaction and Effectiveness is significant ($\beta = 0.014$, $p = 0.031$), lending support to H9. Finally, the interaction term between Millennials and Digital Learning is also significant ($\beta = 0.040$, $p = 0.040$), supporting H10 and indicating that the effectiveness of digital learning strategies may vary depending on generational traits.

Discussions

The results from Table 4 indicate the direct, indirect, and moderating effects among the constructs in the model, supporting or rejecting the ten proposed hypotheses as follows:

Curriculum Innovation has a positive and significant effect on the Effectiveness of Islamic Education

The empirical finding that Curriculum Innovation significantly enhances the Effectiveness of Islamic Education ($\beta = 0.128$, $p = 0.033$) underscores the vital importance of curriculum modernization in religious educational contexts. This result aligns with the study by Mukarom et al. (2024), which emphasizes that successful curriculum innovation in Islamic education must be responsive to digital-age challenges by integrating technology that aligns with Islamic values and enhancing educators' digital competencies (Mukarom et al., 2024b; Mukarom et al., 2024a). Similarly, Azizah et al. (2025) highlighted how transformative curriculum frameworks, such as the “Merdeka Curriculum,” foster student autonomy and Innovation when rooted in digital and value-based pedagogy. Moreover, qualitative literature confirms that combining technological literacy and curriculum reform is essential for meaningful learning outcomes in Islamic education. Taken together, these studies provide robust support for the current finding, suggesting that curriculum innovation is not merely beneficial but essential when thoughtfully designed to integrate digital tools, uphold Islamic values, and prepare millennial learners for the demands of the 21st century.

Lecturer Interaction has a positive and significant effect on the Effectiveness of Islamic Education

The finding that lecturer interaction significantly enhances the effectiveness of Islamic education ($\beta = 0.268$, $p < 0.001$) highlights the critical role of active and engaging communication between lecturers and students in shaping cognitive and moral outcomes. This aligns with Hoerudin and Yuliani's qualitative study (2024), which emphasized that educational interaction rooted in Islamic pedagogy is fundamental for nurturing student moral and intellectual development (Wahyu Hoerudin & Yuliani, 2025). Similarly, Ningsih and Fitria (2023) reported that strong teacher-student interactions in Islamic Religious Education classrooms significantly enhance character development and ethical behaviour (Ningsih & Fitria, 2023). Parallel findings in secular

educational contexts further reinforce this, as interactive teaching practices—such as dialogue journals and active learning strategies consistently produce meaningful gains in student engagement and achievement. The current research reinforces this work by empirically demonstrating that lecturer interaction by facilitating discussion, feedback, and rapport has a robust, positive effect on educational effectiveness in Islamic higher education settings. This underscores the imperative for institutions to invest in developing lecturers' interactional competencies, including interactive pedagogies and digital facilitation training, to maximize Islamic education outcomes.

Digital Learning has a positive and significant effect on the Effectiveness of Islamic Education

Although the impact of Digital Learning on the Effectiveness of Islamic Education is modest, the result remains statistically significant ($\beta = 0.076$, $p = 0.038$), confirming H3 and suggesting that technology-enhanced learning contributes positively, though moderately, to educational outcomes. This finding resonates with empirical studies in Indonesian Islamic education contexts. For example, Pascasarjana's quantitative study showed that integrating digital tools into Islamic Religious Education significantly improved student achievement, with an effect size of 0.78 when supported by teacher technological competence and infrastructure (Integrasi et al., 2025). Similarly, Rohmadani et al. (2024) found that ICT-based teaching in senior high school PAI lessons enhanced student engagement, comprehension, and learning satisfaction. However, it also highlighted barriers related to infrastructure and teacher readiness (Rohmadani et al., 2024). At the elementary level, Fauziah and Achmad (2025) reported significant increases in student motivation when digital media was used in Al-Qur'an and Hadith classes (Fauziah & Achmad, 2025). Additionally, Norman et al. (2025) emphasized that digital transformation in Islamic education through AI and gamification fosters engagement but also requires a balanced integration to preserve Islamic values (Norman et al., 2025).

Curriculum Innovation has a positive and significant effect on Lecturer Interaction.

The substantial positive effect of Curriculum Innovation on Lecturer Interaction ($\beta = 0.442$, $p < 0.001$) highlights how curricular modernization transforms pedagogical dynamics by promoting more engaging teaching methods. This finding aligns with studies demonstrating that adaptive and contextually relevant curricula foster more active and interactive learning environments. For instance, research from UIN Suska

(2024) emphasizes that strategies such as project-based learning and contextual curriculum enhancements significantly bolster classroom interaction and engagement (Muhith et al., 2025). Likewise, a recent study on modernizing Islamic curricula accentuates that integrating 21st-century skills and digital infrastructure enhances lecturers' responsiveness and teaching flexibility (Nur Latifah & Tamam, 2024). Furthermore, innovations aimed at addressing contemporary challenges, such as incorporating anti-bullying principles into the Curriculum, have been shown to create more interactive and values-focused pedagogical approaches, thereby improving lecturer-student rapport. These findings reinforce that intentional curriculum innovation is a critical driver for elevating lecturer interaction in Islamic education, enabling educators to engage students more effectively and meaningfully.

Digital Learning has a positive and significant effect on Lecturer Interaction

The strong positive effect of Digital Learning on Lecturer Interaction ($\beta = 0.498$, $p < 0.001$) demonstrates that digital tools significantly enhance communication and engagement in Islamic educational settings. Studies in Indonesian Islamic education corroborate this finding. Firdaus et al. (2023) report that incorporating multimedia, mobile applications, and interactive platforms increases student participation and deepens lecture–student interactions in Islamic Religious Education (Diana et al., 2024). Mashudi & Hilman (2024) further observe that digital-based Islamic Religious Education elevates student engagement by making learning experiences more interactive, fostering richer interactions between lecturers and students (Mashudi & Hilman, 2024). Additionally, Muiz et al. (2024) note that video-based modules and interactive digital content make religious subjects more accessible, leading to improved communication and personalized feedback in the classroom. These findings reflect broader educational trends; for instance, digital and blended learning strategies have enhanced instructor–learner engagement and fostered active learning. Collectively, this evidence affirms that digital learning environments enrich content delivery and provide platforms for dynamic, responsive lecturer-student interaction, validating H5 and supporting institutional efforts to integrate digital pedagogies in Islamic higher education.

Lecturer Interaction mediates the relationship between Curriculum Innovation and the Effectiveness of Islamic Education

The finding that Lecturer Interaction mediates the relationship between Curriculum Innovation and the Effectiveness of Islamic Education provides compelling

insight into how curricular reforms translate into educational outcomes. This mediated pathway is supported by the strong positive relationships between Curriculum Innovation \rightarrow Lecturer Interaction ($\beta = 0.442$, $p < 0.001$) and Lecturer Interaction \rightarrow Effectiveness ($\beta = 0.268$, $p < 0.001$). This aligns with broader educational research demonstrating that instructional processes often act as vital conduits linking structural interventions to student learning gains. For example, *Frontiers in Education* (2024) reports that digital intelligence technologies positively influence curriculum effectiveness primarily via enhanced teaching effectiveness and student engagement highlighting the crucial mediating role of instructional quality (Wang et al., 2025). Similarly, a moderated mediation study by Zhang et al. (2024) found that teacher-emotional engagement mediated the relationship between teaching strategies and student learning engagement in online environments (Zhang et al., 2024). These findings suggest that, in Islamic higher education, reforms in curriculum design impact learning outcomes most effectively when they improve lecturer-student interaction. The current study extends this evidence by demonstrating that lecturer interaction is the essential transmission channel by which curriculum innovation enhances Islamic education effectiveness—a finding with important implications for policymakers and educators seeking to maximize the impact of curriculum reforms through strengthened pedagogical engagement.

Lecturer Interaction mediates the relationship between Digital Learning and the Effectiveness of Islamic Education.

The finding that Lecturer Interaction mediates the effect of Digital Learning on the Effectiveness of Islamic Education aligns with significant educational research emphasizing the role of interactive pedagogical practices in enhancing technology-enhanced learning outcomes. While the direct impact of digital learning on effectiveness may be modest, this study demonstrates that its true value emerges through the quality of lecturer-student engagement.

Recent studies reinforce this mediated relationship. For instance, Rahayu and Suryani (2024) found that the implementation of e-learning platforms in Islamic law courses significantly improved students' critical thinking and learning outcomes only when lecturers actively facilitated discussions and provided ongoing feedback—highlighting the pivotal role of lecturer interaction in translating technological interventions into meaningful educational outcomes. Similarly, Salamah et al. (2023) demonstrated that digital learning tools such as interactive quizzes and forum-based activities only impacted student achievement when embedded within structured,

dialogic teaching contexts, confirming the mediating function of instructional engagement. A meta-analysis by Lee and Chang (2024) in the *International Journal of Educational Technology* further revealed that “active instructor presence” moderated the impact of blended learning environments on both learner satisfaction and academic performance.

Millennials moderate the relationship between Curriculum Innovation and the Effectiveness of Islamic Education.

The significant interaction between Millennials and Curriculum Innovation ($\beta = 0.080$, $p = 0.005$) suggests that curriculum reforms are slightly more effective when tailored to the preferences of millennial learners. This finding aligns with emerging research highlighting this generation's unique learning habits and technological orientation. For example, integrating millennial learning models in pesantren (Islamic boarding schools) has improved student engagement and academic outcomes in language instruction by blending traditional and innovative pedagogies (Model et al., 2024). Moreover, access to Islamic teachings via digital formats such as podcasts has enhanced the reach and relatability of content among millennials, indicating that modern curriculum formats resonate well with their media-centric consumption patterns (Salman Farid, 2024). Studies on digital natives also show millennials' demand for personalized, interactive, and value-integrated learning experiences can make innovative curricular approaches more impactful in Islamic higher education (Masrurroh, 2025). Therefore, the present finding underscores the need for curriculum innovation to incorporate millennial-friendly design features such as digital access, interactive content, and cultural relevance to maximize educational effectiveness.

Millennials moderate the relationship between Lecturer Interaction and the Effectiveness of Islamic Education.

The statistically significant but modest interaction between Millennials and Lecturer Interaction ($\beta = 0.014$, $p = 0.031$) suggests that lecturer–student engagement has a slightly stronger positive effect on educational outcomes when students possess millennial traits. Although the coefficient is small, this moderation effect aligns with literature emphasizing that millennial learners with digital fluency and who prefer interactive, freedom-based learning environments benefit more from engaging educator-student dialogues. For example, Akbar (2024) reported that millennials “like learning systems that emphasize freedom of expression by asking and answering questions” (Kaawoan et al., 2021; Rustan, 2021). Similarly, research on millennial Islamic education stresses their responsiveness to technology-mediated teaching,

underscoring the need for interactive communication styles that resonate with their digital-native mindset. These findings imply that lecturers who foster interactive, collaborative, and dialogic learning atmospheres, especially through digital means, can leverage millennial learning tendencies to enhance the effectiveness of Islamic education. This highlights the importance of training lecturers in facilitation techniques tailored to millennial preferences, such as incorporating online discussion forums, real-time feedback tools, and reflective digital activities aligned with Islamic values. While the moderating effect is modest, it underscores the nuanced role that generational characteristics play in optimizing pedagogical strategies within Islamic higher education settings.

Millennials moderate the relationship between Digital Learning and the Effectiveness of Islamic Education.

The significant interaction between Millennials and Digital Learning ($\beta = 0.040$, $p = 0.040$) indicates that millennial students characterized by their digital fluency and comfort with technology—derive greater benefits from digital learning tools in Islamic education. This finding is consistent with recent research emphasizing the need to tailor digital pedagogies to the preferences and habits of millennials. For instance, Nurhasanah et al. (2024) found that millennials engage more deeply with Islamic content when delivered via mobile apps and interactive videos, leading to enhanced motivation and comprehension in religious studies (Nabila et al., 2021). Likewise, digital platforms—especially podcast-based learning, have been shown to effectively convey complex Islamic themes to millennials, who appreciate self-paced and on-demand access to religious learning (Shaharudin et al., 2022). Al-Bateel et al. (2025) further argued that digital natives require digital learning environments designed with intuitive interfaces, gamification elements, and value-based content to optimize educational outcomes in Islamic contexts. Collectively, these studies support the current finding by showing that digital learning is most effective when it resonates with millennial learning styles, thus reinforcing H10 and urging educators to adopt millennial-centric digital strategies, such as microlearning modules, gamified quizzes, and responsive interfaces to better serve this learner demographic.

Conclusion

This study aimed to examine the effects of curriculum innovation, lecturer interaction quality, and digital learning styles on the effectiveness of Islamic education, with millennials as a moderating variable. Using an SEM-PLS approach, the findings

revealed that all three independent variables positively influenced educational effectiveness, either directly or indirectly. Curriculum innovation and lecturer interaction showed strong and significant effects, while digital learning, although modest in its direct effect, played a crucial role when mediated by lecturer interaction.

The mediating role of lecturer interaction was confirmed in the relationships between curriculum innovation and digital learning and Islamic education's effectiveness. This underscores the importance of pedagogical engagement in translating structural innovations into meaningful learning outcomes. Additionally, millennial traits were found to significantly moderate the relationships between curriculum innovation, digital learning, and lecturer interaction with educational effectiveness. These results suggest that the impact of educational interventions can be enhanced when aligned with the preferences and learning behaviours of the millennial generation.

In conclusion, the effectiveness of Islamic education in the digital era is best supported by a synergistic approach that integrates innovative curricula, responsive lecturer-student engagement, and adaptive digital learning strategies—especially when tailored to generational characteristics. These findings offer practical implications for Islamic higher education institutions seeking to modernize their pedagogical approaches and foster more impactful learning experiences for today's learners.

Author Contribution Statement

The first author contributed to preparing the research proposal, collecting data, analyzing and reducing the data, compiling it into meaningful units, and verifying the validity of the findings. The second author verified the accuracy of the data analysis results and provided critical feedback to strengthen the interpretation of the findings. The third author contributes ideas about the general view of the educational curriculum and the fourth author's view that education seen from the outside provides an image to be published in reality.

Disclosure 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. We have no conflict of interest to declare.

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