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DIFFERENTIATED LEARNING THROUGH INTERACTIVE INFOGRAPHIC MEDIA IN ISLAMIC RELIGIOUS EDUCATION: EFFECTS ON ENGAGEMENT AND LEARNING OUTCOMES

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ABSTRACT

Islamic Religious Education (PAI) is expected to develop students' religious understanding, moral disposition, and reflective judgment, yet classroom diversity requires instruction that is responsive to differences in readiness, interest, and preferred modes of engagement. This study examined the implementation and effectiveness of differentiated learning supported by interactive infographic media in PAI. A mixed-methods design combined a one-group pretest-posttest quantitative component with qualitative descriptive inquiry. The participants were 34 students selected purposively from a heterogeneous class. Interactive infographics developed with Canva and Genially were organized to support content differentiation through tiered information and embedded multimedia, process differentiation through flexible navigation and paced exploration, and product differentiation through alternative forms of student reflection. Expert validation involved a PAI content expert and an educational-technology expert. Quantitative data were obtained from pretests, posttests, and an engagement questionnaire, while qualitative data were collected through classroom observation and semi-structured interviews. The PAI expert rated the media at 89.5% and the media expert at 91.2%, both in the very valid range. Mean achievement increased from 58.35 to 83.68, with an average N-gain of 0.61 and a significant paired-sample t-test result ($t = -16.42$, $p < .001$). Student engagement was high across behavioral (84.2%), affective (86.5%), and cognitive (81.0%) dimensions. Qualitative findings indicate that flexible multimodal pathways supported student choice and enabled more targeted teacher assistance, although preparation time, digital-design competence, device access, and internet stability remained practical constraints. The findings support interactive infographics as a feasible medium for operationalizing differentiated PAI instruction, while the single-group design limits causal generalization.

Keywords: Differentiated learning, interactive infographic, Islamic Religious Education, student engagement, learning outcomes

I. INTRODUCTION

Islamic Religious Education (Pendidikan Agama Islam or PAI) has a strategic function in developing students' religious knowledge, moral awareness, and capacity to connect Islamic values with everyday decisions. Contemporary classrooms, however, are increasingly heterogeneous. Students enter lessons with different levels of prior knowledge, interests, language resources, digital familiarity, and preferred ways of engaging with learning tasks. Such diversity makes uniform instruction less likely to provide equally meaningful access for all learners. Recent syntheses indicate that differentiated instruction can positively influence learning outcomes when teachers deliberately adapt learning experiences to learner variability (AM et al., 2023; Puzio et al., 2020; Ziernwald et al., 2022).

Differentiated instruction is commonly operationalized by varying what students encounter, how they engage with learning activities, and how they demonstrate

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understanding. The broader literature also shows conceptual overlap between differentiated instruction and inclusive design approaches that seek to provide multiple routes into learning rather than expecting every learner to proceed through an identical pathway (Griful-Freixenet et al., 2020). In this study, differentiation is therefore treated as a proactive pedagogical response to differences in readiness, interest, and learning preference, rather than as a fixed classification of students into permanent learning-style categories.

At the same time, digital media have become increasingly important in teaching and learning. Systematic reviews show that educational technologies can support behavioral, affective, and cognitive engagement when their use is pedagogically purposeful and when learners are offered meaningful opportunities to interact with content rather than merely view it (Bond, 2020; Bond et al., 2020; Nkomo et al., 2021). Multimedia learning research further emphasizes that well-designed combinations of words, images, and carefully selected interactive elements can support cognitive processing when they reduce extraneous load and highlight essential information (Mayer, 2020).

This development is particularly relevant to PAI. Studies in Indonesia document the increasing use of digital and social media for Islamic religious learning, including TikTok-based learning and interactive online platforms (Putri & Astutik, 2021; Nugraha et al., 2021). A recent review of innovative digital media in PAI also identifies social-media-based learning as an expanding area of instructional innovation (Susanti et al., 2024). Yet much of this work focuses on the adoption of a platform or medium itself. It does not always explain how digital media can be deliberately structured to respond to within-class differences in readiness, interest, and engagement.

Recent PAI research has begun to address differentiated learning more directly. Ramadani and Inayati (2024) describe content, process, and product differentiation in PAI and identify both supportive and inhibiting classroom conditions. Alfaiz and Aimah (2025) similarly show how differentiated strategies can be connected to digital literacy and project-based activity in PAI. In parallel, Januri et al. (2025) report a clear need for interactive infographic media in religious education at junior-high-school level. These studies suggest a promising intersection between differentiated pedagogy and interactive visual media, but empirical evidence remains limited on an instructional model that integrates both elements and simultaneously examines achievement, student engagement, teacher practice, and implementation constraints.

Interactive infographics provide a practical response to this gap because they can combine concise text, diagrams, linked layers, audio, short video, quizzes, and learner-controlled navigation within a single visual interface. Experimental evidence indicates that interactive infographics can support academic achievement more effectively than static versions in certain learning contexts (Ismaeel & Al Mulhim, 2021). When these features are intentionally organized as tiered content, flexible learning routes, and multiple options for student products, the infographic becomes more than a presentation aid: it functions as an instructional environment for differentiation.

Accordingly, this study aimed to analyze the implementation and effectiveness of interactive infographic-based differentiated learning in PAI. The study addressed three questions: (1) How can interactive infographic media operationalize content, process, and product differentiation in PAI? (2) To what extent do student cognitive learning outcomes and

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engagement change after the intervention? and (3) What opportunities and challenges are experienced by teachers and students during classroom implementation? The study is expected to contribute an applied model for technology-supported differentiated PAI learning and to identify practical conditions required for sustainable classroom use.

II. REVIEW OF LITERATURE

Differentiated Instruction and Learner Variability

Differentiated instruction is a responsive approach in which teachers proactively adjust instructional pathways based on evidence about learner needs. Contemporary evidence supports the general potential of this approach while also showing that implementation quality matters. AM et al. (2023), in a systematic review and meta-analysis of 49 primary studies, reported a significant overall effect of differentiated instruction on learning outcomes. Puzio et al. (2020) likewise found a positive overall effect in literacy instruction, while Ziernwald et al. (2022) highlighted the value of differentiated practice in mixed-ability classrooms for high-achieving learners. Together, this literature suggests that differentiation should not be understood as simplifying learning for some students and enriching it only for others; it is a structured effort to provide appropriately challenging access points for all learners.

The present study uses three practical dimensions of differentiation: content, process, and product. Content differentiation concerns the depth, complexity, representation, or sequence of material. Process differentiation concerns the routes, supports, grouping arrangements, pace, and activities through which learners make sense of the material. Product differentiation concerns the forms through which learners demonstrate understanding. This framework aligns with recent PAI classroom research that documents the use of these three dimensions in response to student diversity (Ramadani & Inayati, 2024; Alfaiz & Aimah, 2025). At the same time, the present study treats visual, auditory, and kinesthetic categories as preferences for particular modes of engagement rather than as fixed cognitive types.

Interactive Infographics and Multimedia Learning

An infographic organizes information through coordinated visual and verbal representations. In interactive form, it can also include clickable nodes, embedded audio or video, progressive disclosure of information, short assessment prompts, and non-linear navigation. This combination is relevant to multimedia learning because learners can be guided toward essential information while controlling the sequence or depth of exploration. Mayer (2020) emphasizes that multimedia is most effective when design supports selection, organization, and integration of information rather than adding decorative stimulation. Thus, the instructional value of an interactive infographic depends on signaling, coherence, segmentation, and the meaningful relationship between visual and verbal elements.

Empirical work supports the educational potential of interactive infographics. Ismaeel and Al Mulhim (2021) found differences in academic achievement associated with interactive versus static infographic formats, highlighting the importance of learner interaction with visual information. In religious education specifically, Januri et al. (2025) identified student and teacher demand for interactive infographic learning media and reported perceived

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benefits for comprehension and engagement. These findings provide a foundation for examining the medium not only as visual communication but as a platform for differentiated pathways.

Digital Pedagogy in Islamic Religious Education

Digital transformation in PAI has expanded the range of learning resources available to teachers and students. Putri and Astutik (2021) demonstrate how short-form social media can be used as a medium for presenting PAI topics to Generation Z, while Nugraha et al. (2021) report improved participation and learning outcomes after the use of Bookwidgets in online PAI learning. Susanti et al. (2024) further synthesize the use of TikTok, YouTube, WhatsApp, Facebook, and Instagram in PAI learning. This literature indicates that digital media can make religious learning more accessible and engaging, but effectiveness depends on purposeful pedagogical design rather than technological novelty alone.

Teacher capacity is therefore central. Falloon (2020) argues that digital competence extends beyond operational skills to the ability to select and use technologies in pedagogically appropriate ways. Differentiated instruction adds another layer of complexity because teachers must design multiple pathways while preserving clear learning objectives. Kahmann et al. (2022) show that professional development can improve teachers' knowledge and differentiation practices, with subject-specific professional development being particularly relevant. For PAI, this implies that sustainable interactive-infographic use requires integration of religious-content expertise, differentiated pedagogy, and digital-design competence.

Conceptual Integration for the Present Study

The conceptual proposition of this study is that interactive infographic media can function as a digital architecture for differentiated PAI instruction when its interactive features are deliberately mapped onto content, process, and product decisions. Tiered nodes and layered explanations support content differentiation; flexible paths, embedded media, short quizzes, and individual or small-group exploration support process differentiation; and alternative forms of reflection or performance support product differentiation. Student engagement is treated as multidimensional, encompassing observable participation, affective involvement, and cognitive investment, consistent with the engagement literature synthesized by Bond et al. (2020) and Nkomo et al. (2021).

III. METHOD

Research Design and Setting

This study employed a mixed-methods design combining a one-group pretest-posttest quantitative component with qualitative descriptive inquiry. The quantitative component was used to examine changes in PAI cognitive learning outcomes and student engagement, while the qualitative component was used to describe how differentiation operated in classroom practice and to identify perceived benefits and constraints. The research was conducted at [Insert School Name] during the [Insert Academic Year] academic year within a selected PAI instructional unit. This formulation reflects the actual single-group structure of the study and avoids attributing causal effects that would require a separate control or comparison group.

Participants and Sampling

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The target population comprised [Insert Grade/Level] students. One class of 34 students was selected purposively because the class displayed heterogeneity in initial academic readiness, interests, and self-reported preferences for visual, auditory, and hands-on modes of engagement. The purposive strategy was intended to provide an appropriate context for examining differentiated instruction within a naturally diverse classroom. Student categories were used as planning information and were not treated as fixed or exclusive learning identities.

Interactive Infographic Intervention

The instructional media were developed using Canva and Genially and were aligned with the selected PAI curriculum topic. The design translated differentiated instruction into three dimensions. Content differentiation was implemented through tiered information layers, concise foundational explanations, extension materials, and embedded multimedia nodes. Process differentiation was implemented through flexible navigation, self-paced or small-group exploration, short interactive checks, audio explanations, visual maps, and hands-on digital activities. Product differentiation was implemented by allowing students to select from several formats for demonstrating understanding, including visual mind maps, short audio reflections, and brief written reflections or mini-essays. The intervention was implemented during the selected instructional unit under teacher facilitation.

Validation and Research Instruments

Before classroom use, the interactive infographic was reviewed by one PAI subject-matter expert and one educational-technology expert. The validation rubric covered content accuracy, alignment with learning objectives and differentiated instruction, visual organization, usability, and interactive functionality. Quantitative instruments consisted of a pretest and posttest measuring cognitive learning outcomes and a Likert-scale engagement questionnaire covering behavioral, affective, and cognitive engagement. Qualitative instruments consisted of a structured classroom-observation rubric and semi-structured interview guides for the PAI teacher and representative students.

Data Analysis

Pretest and posttest scores were summarized using means, standard deviations, minimum and maximum scores. The distribution of paired difference scores was examined before applying a paired-sample t-test. Learning improvement was also summarized using the normalized gain (N-gain). An average N-gain of 0.61 is interpreted in this article as a moderate gain under the commonly used cut points (<0.30 low; 0.30-0.69 moderate; >=0.70 high). Engagement questionnaire results were converted to percentages by dimension. Observation notes and interview transcripts were analyzed thematically through iterative familiarization, coding, theme development, review, and interpretation, drawing on quality principles for reflexive thematic analysis (Braun & Clarke, 2021). Quantitative and qualitative findings were integrated in the discussion to examine convergence and practical meaning.

Ethical Considerations

Participation procedures should follow the ethical requirements of the relevant institution and school. Before submission for publication, the author should complete the manuscript with the applicable approval or permission statement, informed-consent procedure, and data-confidentiality arrangements for the participating students. No personally identifying student information is reported in the present manuscript draft.

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IV. RESULTS AND DISCUSSION

RESULTS

Expert Validation of Media and Content

Expert review indicated that the interactive infographic was suitable for classroom implementation. The PAI content expert awarded a score of 89.5%, categorized as very valid, and noted strong alignment between the material and the stated learning objectives. The educational-technology expert awarded a score of 91.2%, also categorized as very valid, and confirmed the usability of clickable nodes, audio overlays, embedded media, and navigation features. These results indicate that the media met both content and technical criteria prior to classroom use.

Table 1- Summary of Expert Validation Results

Validator	Score	Category	Main focus
PAI content expert	89.5%	Very valid	Content accuracy and alignment with learning objectives
Educational-technology expert	91.2%	Very valid	Visual design, usability, navigation, and interactive functionality

Cognitive Learning Outcomes

All 34 participating students completed both pretests and posttests. The mean score increased from 58.35 before the intervention to 83.68 after the intervention, representing a mean increase of 25.33 points. The paired-sample t-test produced $t = -16.42$ with $p < .001$, indicating a statistically significant difference between the two measurement occasions. The average N-gain was 0.61, which is interpreted as a moderate improvement. Table 2 summarizes the quantitative results.

Table 2- Statistical Summary of Pretest, Posttest, and N-Gain Scores

Parameter	Pretest	Posttest	Statistical summary
Sample size (N)	34	34	-
Mean score	58.35	83.68	Mean difference = +25.33
Standard deviation	8.92	6.74	-
Minimum score	42.00	70.00	-
Maximum score	75.00	95.00	-
Average N-gain	-	-	0.61 (Moderate)
Paired-sample t-test	-	-	$t = -16.42$; $p < .001$

The statistical pattern suggests that students performed substantially better after the differentiated infographic intervention. Because the study did not include a control group, however, the improvement should be interpreted as a within-group change associated with the instructional period rather than as definitive evidence that the media alone caused the gain. This distinction is important for aligning the strength of the conclusion with the research design.

Student Engagement

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Post-intervention questionnaire data indicated high engagement across all three measured dimensions. Affective engagement produced the highest percentage (86.5%), followed by behavioral engagement (84.2%) and cognitive engagement (81.0%). The pattern suggests that students not only participated in the interactive tasks but also reported positive emotional responses and sustained mental effort during learning.

Table 3- Student Engagement by Dimension

Dimension	Percentage	Observed / reported indicator
Behavioral engagement	84.2%	Active navigation, participation in embedded mini-quizzes, and task completion
Affective engagement	86.5%	Positive feelings toward the lesson, greater interest, and reduced boredom
Cognitive engagement	81.0%	Re-reading, self-correction, and use of layered nodes to understand complex concepts

Qualitative Implementation Findings

Classroom observations and interviews clarified how the interactive infographic supported *differentiated* practice. Students who preferred visual representations frequently used mind maps, flowcharts, and structured diagrams; students who preferred listening made greater use of audio explanations and recitation clips; and students who preferred hands-on interaction were particularly active in drag-and-drop and other manipulable tasks. These patterns are interpreted as preferences for modes of engagement rather than evidence of fixed learning-style types.

Table 4- Operationalization of Differentiation through Interactive Infographics

Dimension	Interactive infographic feature	Observed classroom pattern
Content	Tiered nodes, foundational summaries, extension links, embedded multimedia	Students with lower initial readiness revisited foundation layers, while more advanced students accessed extension material and case examples.
Process	Flexible navigation, self-paced routes, audio/visual resources, mini-quizzes, small-group exploration	Students followed different pathways and repeated or skipped nodes according to need; the teacher redirected support to students requiring additional scaffolding.
Product	Choice among audio reflection, visual mind map, and short written reflection / mini-essay	Students demonstrated understanding in different formats while working toward the same lesson objectives.

The PAI teacher reported that self-directed navigation reduced the need for continuous whole-class lecturing and created more opportunities for targeted support. Students generally perceived the interactive visual format as more concrete and enjoyable than text-heavy instruction. At the same time, the teacher identified substantial preparation time as a barrier because multi-path infographic design requires careful planning, digital-design skills, and checking of each interactive link. Device availability and stable internet access were also recognized as conditions that could affect implementation quality.

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Learning Outcomes and Multimedia Processing

The improvement from a mean pretest score of 58.35 to a mean posttest score of 83.68 is consistent with the proposition that structured multimedia can make complex information easier to select, organize, and integrate. Mayer (2020) argues that multimedia learning is strengthened when words and graphics are coordinated and when unnecessary cognitive demands are reduced. The interactive infographic in this study used layered explanations, signaling, short media segments, and learner-controlled navigation, all of which can reduce the burden of processing long, linear blocks of text. The result also corresponds with Ismaeel and Al Mulhim (2021), who found academic benefits associated with interactive infographic formats compared with static alternatives.

The observed N-gain of 0.61 also fits the broader differentiated-instruction literature. Meta-analytic evidence reported by AM et al. (2023) suggests that differentiated instruction can improve learning outcomes across varied contexts, while Puzio et al. (2020) and Ziernwald et al. (2022) demonstrate that carefully designed differentiation can support learners with different achievement profiles. In the present PAI setting, the likely instructional value lies not in the infographic alone but in the way the medium made multiple levels of explanation and pathways available without fragmenting the class into entirely separate lessons.

Multidimensional Engagement

The engagement percentages show that the strongest response occurred in the affective dimension, followed by behavioral and cognitive engagement. This pattern is plausible in an interactive digital environment in which students can choose paths, receive immediate prompts, and interact with visually organized material. Systematic reviews of digital learning emphasize that technology can support participation, enjoyment, interaction, and cognitive investment when tasks are designed around active learning rather than passive exposure (Bond, 2020; Nkomo et al., 2021). Bond et al. (2020) similarly map engagement with educational technology as a multidimensional construct, reinforcing the need to assess more than simple attendance or device use.

For PAI specifically, the engagement results extend existing studies of digital religious learning. Putri and Astutik (2021) show that familiar digital formats can increase the attractiveness of PAI content for Generation Z, while Nugraha et al. (2021) report improved participation and outcomes after introducing an interactive online tool. Susanti et al. (2024) also demonstrate the expanding variety of social and digital media used in PAI. The present study adds a differentiated-design perspective by linking media features to different levels of readiness and to choices in learning process and product.

Differentiated PAI and Teacher Facilitation

The qualitative results directly support the feasibility of operationalizing content, process, and product differentiation through one interactive platform. This finding is congruent with Ramadani and Inayati (2024), who describe these three forms of differentiation in PAI, and with Alfaiz and Aimah (2025), who connect differentiated PAI with digital literacy and flexible project work. The present model demonstrates how a teacher can maintain shared curriculum goals while varying the depth of information, the route through material, and the form of student response.

An important practical implication is the shift in teacher role. Because students could revisit nodes and move through parts of the infographic with some autonomy, the teacher

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had more opportunity to work with individuals or small groups. This does not remove the need for teacher guidance; rather, it reallocates teacher attention from continuous presentation toward diagnosis, scaffolding, feedback, and orchestration. Such a role requires both pedagogical judgment and digital competence. Falloon (2020) emphasizes that teacher digital competence involves purposeful integration rather than technical operation alone, and Kahmann et al. (2022) show that professional development can strengthen teachers' differentiation knowledge and practice.

Practical Challenges and Technological Readiness

The major implementation challenge was the time and expertise needed to prepare multi-path interactive media. Designing tiered content requires more than converting a printed page into a digital slide: the teacher must anticipate learner needs, build alternative routes, check cognitive load, prepare meaningful interactions, and ensure that all options remain aligned with the same outcomes. School infrastructure is an additional condition. Limited devices, unstable internet, or blocked external links can interrupt navigation and reduce the advantages of interactivity. These findings support Januri et al. (2025), who identified a need for interactive infographic media in religious education, while also indicating that adoption should be accompanied by reusable templates, collaborative repositories, and teacher training rather than placing the entire design burden on individual teachers.

DISCUSSION

The findings of this study suggest that interactive infographics can serve as more than an attractive digital presentation tool in Islamic Religious Education (PAI). When deliberately designed around content, process, and product differentiation, they can function as an instructional architecture that provides students with different entry points, pathways, and modes of demonstrating understanding while maintaining common learning objectives. This interpretation is important because the observed improvement cannot reasonably be attributed to technological novelty alone. The participating students experienced a structured intervention in which layered content, flexible navigation, embedded multimedia, interactive checks, and alternative response formats were deliberately aligned with differentiated pedagogy. The quantitative results showed an increase in mean achievement from 58.35 to 83.68, a statistically significant paired difference, and a moderate N-gain of 0.61; however, the absence of a comparison group means that these findings indicate substantial within-group improvement rather than definitive causal effectiveness. The central contribution of the findings therefore lies not in claiming that interactive infographics independently “cause” higher achievement, but in demonstrating the feasibility and pedagogical promise of combining differentiated instruction with interactive multimedia in PAI.

This distinction is consistent with the broader literature on differentiated instruction. Differentiation is most effective when it responds systematically to variations in students’ readiness, interests, and ways of engaging with learning rather than simply providing different tasks to different students. Tomlinson (2017) emphasizes that differentiation requires teachers to maintain high-quality common curricular goals while varying the routes through which students gain access to those goals. ASCD Similarly, AM et al. (2023) found a positive overall effect of differentiated instruction across a substantial body of empirical research, while Puzio et al. (2020) and Ziernwald et al. (2022) demonstrate that differentiation can

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benefit students across differing levels of academic readiness. The present study extends this literature by illustrating how differentiation can be embedded within one digital environment rather than requiring entirely separate instructional materials. Students who required foundational support could return to basic explanatory layers, whereas students with stronger initial readiness could move toward extension materials and examples. This is pedagogically significant because it suggests that differentiation does not necessarily require fragmenting the class into fixed ability groups; instead, a well-designed digital environment can make different levels of support simultaneously available.

The findings also clarify how differentiation was operationalized rather than merely declared as an instructional principle. The interactive infographic provided tiered information for content differentiation, flexible navigation and multimodal resources for process differentiation, and several options for student products, including visual, audio, and written responses. Classroom observations further indicated that students used these options differently according to their needs and preferences. This is consistent with Ramadani and Inayati (2024), who identify content, process, and product as central dimensions of differentiated PAI instruction, and with Alfaiz and Aimah (2025), who connect differentiated PAI with digital literacy and flexible learning activity. At the same time, the present findings should not be interpreted through a rigid "learning styles" perspective. Students' use of visual diagrams, audio explanations, or interactive tasks should be understood as situational preferences and strategic choices rather than evidence that learners possess fixed visual, auditory, or kinesthetic identities. This position is more consistent with inclusive design approaches described by Griful-Freixenet et al. (2020), where learner variability is addressed by providing multiple forms of representation and participation rather than assigning students to permanent cognitive categories.

The increase in cognitive learning outcomes can also be interpreted through multimedia learning theory. Mayer (2020) argues that multimedia can support learning when words and visual representations are coordinated in ways that help learners select relevant information, organize it coherently, and integrate it with prior knowledge. In the present intervention, information was segmented into layered explanations and supported by signaling, concise text, visual representations, audio, and learner-controlled navigation. These features may have reduced the burden associated with processing long, linear text and allowed students to revisit difficult material according to need. The finding is consistent with Ismaeel and Al Mulhim (2021), who found stronger academic outcomes under interactive infographic conditions than under static infographic conditions. Nevertheless, interactivity itself should not be treated as inherently beneficial. Additional buttons, animations, links, or audiovisual components can increase rather than decrease cognitive demand when they are decorative, poorly sequenced, or unrelated to learning objectives. Thus, the positive pattern observed in this study appears more plausibly connected to the pedagogical organization of interactivity than to the mere presence of digital features.

This interpretation is particularly relevant in PAI, where learning often involves conceptually dense material, value-based reflection, scriptural content, and the translation of abstract religious concepts into everyday understanding. Interactive visual organization may help make relationships between concepts more explicit, while audio, short video, and layered examples can support students who need additional contextualization. Previous

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studies have already demonstrated the increasing role of digital media in PAI. Putri and Astutik (2021) showed the potential of TikTok as a medium for Islamic religious learning among Generation Z, Nugraha et al. (2021) reported improved participation and achievement through Bookwidgets, and Susanti et al. (2024) documented a wider expansion of social and digital platforms in PAI. However, these studies primarily demonstrate the educational potential of particular technologies. The present study adds an important pedagogical dimension by asking not only whether digital media can be used in PAI, but how the internal design of a digital medium can respond to learner variability. This shift from technology adoption toward pedagogically structured technology is arguably one of the more important contributions of the study.

Student engagement data further reinforce this interpretation. Engagement was high in all three measured dimensions, with affective engagement reaching 86.5%, behavioral engagement 84.2%, and cognitive engagement 81.0%. Students demonstrated active navigation, participation in mini-quizzes, task completion, positive attitudes, reduced boredom, re-reading, self-correction, and purposeful use of layered nodes. These results support the multidimensional conception of engagement developed by Fredricks et al. (2004), who distinguish behavioral, emotional, and cognitive dimensions rather than treating engagement as simple attendance or observable participation. Sage Journals They are also consistent with the evidence maps and systematic reviews of Bond et al. (2020), Bond (2020), and Nkomo et al. (2021), which show that educational technology can support multiple forms of engagement when students actively interact with tasks rather than merely consume digital content.

The relatively high affective engagement deserves particular attention. Students reported greater interest and less boredom, suggesting that the intervention affected not only task completion but also students' emotional experience of the lesson. This matters because emotional engagement can influence students' willingness to invest effort and persist with demanding tasks. Yet high enjoyment should not automatically be equated with deep learning. A visually attractive environment may generate positive emotional responses without necessarily producing durable conceptual understanding. The fact that cognitive engagement was slightly lower than affective and behavioral engagement therefore warrants a more critical reading. An 81.0% cognitive engagement score is still high, but it suggests that future iterations should continue to emphasize activities requiring interpretation, reasoning, comparison, application, and reflection rather than allowing interactive navigation itself to become the primary activity. In PAI especially, meaningful learning should extend beyond remembering concepts toward the interpretation and application of religious values.

The qualitative findings provide an important explanation for why engagement and achievement may have improved together. Students were able to repeat nodes, skip information they already understood, choose different representations, and demonstrate understanding in different formats. In this sense, learner agency may be one of the mechanisms connecting differentiation with engagement. Interactive infographics gave students a degree of control over pace, sequence, and mode of participation without abandoning the teacher-defined learning objectives. This balance is crucial. Excessive learner freedom can produce fragmented exploration, while excessive instructional control can reduce autonomy. The findings suggest a productive middle position in which students

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receive bounded choice: the teacher establishes curricular goals and the architecture of learning, but students have flexibility in how they navigate and respond to that architecture.

The intervention also altered the teacher's instructional role. The PAI teacher reported that learner-controlled navigation reduced dependence on continuous whole-class explanation and created more opportunities for targeted assistance. This finding is theoretically important because differentiated instruction is not simply a matter of providing more resources; it requires teachers to diagnose learner needs, monitor progress, provide scaffolding, and adjust support. The interactive infographic therefore did not replace teacher mediation. Rather, it redistributed teacher attention from continuous transmission toward facilitation and responsive support. Falloon (2020) argues that meaningful digital competence involves pedagogical decision-making rather than technical operation alone. Likewise, Kahmann et al. (2022) show that professional development can strengthen teacher knowledge and practice in differentiated instruction. Taken together, these insights indicate that the sustainability of this model depends on teachers possessing three interconnected forms of competence: knowledge of PAI content, capacity to design differentiated instruction, and sufficient digital-design competence to translate pedagogical decisions into functional media.

This requirement simultaneously represents the model's principal strength and one of its most serious limitations. The teacher identified preparation time and digital-design skill as important barriers, while device availability and internet stability were also recognized as implementation conditions. It similarly found a need for interactive infographic media in religious education, but "need" should not be confused with implementation readiness. Developing layered content, interactive links, multimedia, assessment prompts, and multiple learning routes places a substantial design burden on teachers. If every teacher must construct complex interactive media independently, the innovation may be difficult to sustain. The practical implication is that implementation should be institutionally supported through reusable templates, shared repositories, collaborative design teams, technical assistance, and structured professional development.

Infrastructure also introduces an equity issue that deserves stronger emphasis. Interactive digital differentiation may broaden access within a lesson for students with different readiness levels, but it can simultaneously produce another form of exclusion when students lack reliable devices, connectivity, or digital familiarity. Thus, pedagogical differentiation and digital equity must be considered together. A design that is instructionally flexible but technologically inaccessible cannot be described as genuinely inclusive. Schools adopting this model should therefore consider offline versions, device-sharing arrangements, downloadable materials, and low-bandwidth alternatives. In this respect, the connection between differentiated instruction and Universal Design for Learning identified by Griful-Freixenet et al. (2020) is particularly relevant: flexibility should address not only cognitive variability but also variation in access conditions.

The results also invite a more critical interpretation of the statistically significant learning gain. The paired-sample t-test ($t = -16.42$, $p < .001$) establishes that pretest and posttest scores differed substantially within the sample, but statistical significance does not identify the source of the change. The intervention occurred without a control group, so maturation, repeated testing, teacher attention, novelty effects, concurrent learning activities, or other

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contextual factors cannot be ruled out. The manuscript itself appropriately acknowledges this limitation. For this reason, the moderate N-gain of 0.61 is perhaps more informative as a descriptive indicator of improvement than as evidence of causal efficacy. Future research should compare differentiated interactive infographics with conventional instruction, static infographics, and non-differentiated interactive media. Such comparisons would help determine whether gains arise primarily from differentiation, interactivity, multimedia design, teacher facilitation, or their combination.

The mixed-methods structure nevertheless strengthens the interpretation of the findings because quantitative change is accompanied by qualitative evidence explaining how the learning environment operated. Observation and interview data indicated that students used different routes and resources, while teachers could redirect support toward students requiring additional scaffolding. The study therefore goes beyond reporting a score increase and begins to identify plausible instructional mechanisms. The thematic treatment of interviews and observations is consistent with the reflexive and iterative analytic principles described by Braun and Clarke (2021). Still, the qualitative component would become more persuasive if the final manuscript included representative verbatim quotations from the PAI teacher and students. Direct quotations could substantiate claims about perceived enjoyment, autonomy, difficulty, and teacher workload, thereby making the connection between themes and participants' actual experiences more transparent.

Overall, the findings support a model of pedagogically structured digital differentiation in which technology is valuable because it makes instructional responsiveness operationally manageable. This conclusion is consistent with the broader differentiated-instruction literature (AM et al., 2023; Puzio et al., 2020; Tomlinson, 2017; Ziernwald et al., 2022), multimedia learning principles (Mayer, 2020), engagement research (Bond et al., 2020; Fredricks et al., 2004; Nkomo et al., 2021), and emerging scholarship on digital PAI (Alfaiz & Aimah, 2025; Nugraha et al., 2021; Putri & Astutik, 2021; Ramadani & Inayati, 2024; Susanti et al., 2024). The innovation therefore lies less in the use of Canva or Genially themselves and more in the purposeful mapping of technological affordances onto differentiated pedagogical decisions.

The findings should consequently be interpreted as promising evidence of feasibility, engagement, and within-group improvement rather than proof of universal effectiveness. The model appears capable of making heterogeneous PAI classrooms more responsive without abandoning shared curricular objectives, but its sustainability depends on teacher competence, preparation time, institutional support, device access, and reliable connectivity. Future studies should employ controlled or quasi-experimental designs, larger and more diverse samples, multiple schools, delayed posttests, and longitudinal follow-up to examine retention and scalability. They should also investigate whether specific components tiered content, learner-controlled navigation, multimedia explanation, formative quizzes, or product choice make distinct contributions to learning and engagement. Such research would move the field beyond asking whether digital media "work" in PAI toward the more educationally consequential question of which digital design features work, for whom, under what conditions, and through which pedagogical mechanisms.

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V. CONCLUSION

This study examined differentiated learning supported by interactive infographic media in Islamic Religious Education. The media received very valid ratings from both content and educational-technology experts. Among 34 students, the mean cognitive score increased from 58.35 to 83.68, the paired-sample t-test was significant ($t = -16.42$, $p < .001$), and the average N-gain was 0.61, indicating a moderate improvement. Student engagement was high across behavioral, affective, and cognitive dimensions. Qualitative evidence further showed that tiered content, flexible multimedia pathways, and alternative response formats enabled differentiation of content, process, and product within a shared PAI lesson.

The instructional value of interactive infographics lies in the integration of medium and pedagogy. When carefully designed, the platform can provide concise visual organization, multiple levels of explanation, learner-controlled navigation, embedded interactions, and varied forms of student demonstration while allowing teachers to direct support where it is most needed. However, the model also requires preparation time, teacher digital competence, reliable devices, and stable connectivity. Because this study used a single-group design, its results should be interpreted as promising evidence of feasibility and within-group improvement rather than definitive causal proof. Further controlled, multi-site, and longitudinal studies are recommended to test effectiveness, retention, and scalability.

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