



Student Engagement and Islamic History Understanding in Two Classes Using Different Instructional Media

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ABSTRACT

This study examines the effectiveness of interactive screen-based instruction in enhancing student engagement and comprehension of Islamic Cultural History materials at MAN 2 Kuningan, West Java, Indonesia. Employing a quasi-experimental design with a non-equivalent control group pretest-posttest scheme, the study involved 64 eleventh-grade students divided equally into an experimental group receiving interactive screen-based instruction and a control group receiving conventional teaching methods across eight instructional sessions over six weeks. Student comprehension was measured using a validated 40-item multiple-choice test, while engagement was assessed through a 24-item instrument covering behavioral, cognitive, and emotional subscales. Data were analyzed using independent-samples t-tests, paired-samples t-tests, and analysis of covariance. Results demonstrate that the experimental group achieved significantly higher posttest comprehension scores and engagement levels across all subscales compared to the control group, with practically meaningful effect sizes observed throughout. These findings indicate that interactive screen technology, when purposefully integrated, functions as a transformative pedagogical environment that reduces extraneous cognitive load, activates multimodal learning channels, and sustains affective investment in historically complex subject matter. The study contributes original empirical evidence to the underexplored intersection of educational technology and Islamic humanities education, with implications for madrasah curriculum development, teacher professional development, and national digital transformation policy.

INTRODUCTION

The digital transformation in education has opened significant opportunities for improving the quality of learning across various levels, including at state Islamic senior secondary schools (Madrasah Aliyah Negeri). One technological innovation now widely implemented in classrooms is the interactive screen, also referred to as an interactive whiteboard or smartboard, which enables teachers to deliver instructional content in a visual, dynamic, and participatory manner. In the context of Islamic Cultural History (Sejarah Kebudayaan Islam/SKI), the presence of technology-based instructional media becomes highly relevant in fostering active student engagement and deep conceptual understanding.

Interactive screens function as multimedia platforms that integrate text, images, video, animation, and collaborative features. These platforms differ from conventional chalkboards because they allow simultaneous display of authentic historical sources, civilizational maps, and real time historical simulations (Hillmayr et al., 2020).

This study defines the term interactive screen as a touch enabled flat panel display integrated with instructional software that allows real time content manipulation. This includes digital



annotation, drag and drop historical timelines, embedded audio visual material, and in class interactive quizzes.

Three components are commonly conflated in prior literature on interactive screens. The device effect refers to the technical affordance of the touch panel hardware itself. The multimedia effect refers to the cognitive benefit derived from dual channel visual verbal presentation, as described in the Cognitive Theory of Multimedia Learning (Mayer, 2021).

The pedagogical strategy effect refers to instructional design choices such as collaborative tasks and formative quizzing, which could in principle be delivered without a digital device. This study treats the interactive screen as a platform through which multimedia content and student centered strategies are jointly delivered. It does not attempt to isolate the unique contribution of the hardware from that of the content design or teaching strategy.

MAN 2 Kuningan is one of the leading state Islamic senior secondary schools in Kuningan Regency, West Java. The school has committed to integrating information and communication technology into its instructional processes. It carries a dual responsibility to produce students who are academically competent and who possess a deep understanding of Islamic history and civilizational heritage. Islamic Cultural History occupies a strategic position in the madrasah curriculum because it shapes students' Islamic identity and historical consciousness (Yusuf & Sari, 2022).

Islamic Cultural History instruction on the ground continues to face considerable challenges. Conventional approaches dominated by lecture and memorization frequently produce passive learning environments. Students often remain unmotivated and unable to construct meaningful understanding. Interactive screens hold potential relevance as a vehicle for shifting the pedagogical paradigm from teacher centered to student centered instruction, while preserving the Islamic values at the core of the curriculum (Mukhlisin et al., 2024; Zain et al., 2021).

Low student engagement in Islamic Cultural History learning is not solely attributable to a lack of interest. Conventional methods often fail to present material in an engaging and contextually meaningful manner. Generation Z students, who grew up in the digital age, tend to respond more strongly to visual, interactive, and multimodal stimuli. This creates a widening gap between student learning needs and the pedagogical approaches employed by teachers (Abidin & Tohir, 2021; Puspitasari et al., 2023).

Preliminary observation at MAN 2 Kuningan indicates that interactive screens are available in several classrooms. Their utilization in Islamic Cultural History instruction remains suboptimal and has not been systematically evaluated. Empirical data on how this technology influences student engagement and comprehension in Islamic history material remain unavailable. No prior study conducted in a comparable setting has attempted to separate the contribution of the device from that of the multimedia content or pedagogical strategy delivered through it.

Table 1 summarizes prior empirical studies on interactive digital tools in instructional settings. Each study is evaluated against three criteria. The first concerns whether device, multimedia, and pedagogical effects are conceptually separated. The second concerns whether design and sample information is fully reported. The third concerns the type of inference the design supports.

Table 1. Comparative matrix of prior research

Study	Design & Sample	Key Finding	Gap Identified
Hillmayr et al. (2020)	Meta analysis, 92 studies; individual N not specified	Positive effect on achievement, larger at secondary level [<i>verify effect size</i>]	Device, multimedia, and pedagogy effects pooled together; not subject specific

Turgut & Temur (2022)	Quasi experimental; sample size not stated [verify]	Significant gain in concept understanding ($p < .01$); higher motivation	Assignment procedure and sample unclear
Marzuki et al. (2021)	Design and sample not stated [verify]	Improved engagement and comprehension	Design and sampling require verification
Zain et al. (2021)	Comparative, gain score; sample not stated [verify]	Higher gain score (0.42) versus conventional [verify]	Same subject as present study, but device/media undefined and sample undocumented
Puspitasari et al. (2023)	Design not stated [verify]	Higher emotional and cognitive engagement	Comprehension outcomes not addressed
Abidin & Tohir (2021)	Correlational; sample not stated [verify]	$r = .67$, $p < .05$ with motivation [verify]	Correlational design cannot support causal or comparative claims

Table 1 indicates that three gaps remain unresolved in the existing literature. No reviewed study separates the device effect from the multimedia effect or the pedagogical strategy effect, leaving unclear which component drives reported gains. Studies specific to Islamic Cultural History, such as Zain, do not report sample size or informant characteristics, limiting transparency and replicability. Several studies, including Abidin and Tohir, use correlational designs that cannot support the causal or comparative language often used to describe their findings.

The present study addresses these gaps in three ways. It separates the device, multimedia, and pedagogical components of the intervention in its conceptual framing. It reports sample size and informant characteristics in full. It calibrates its research questions to the inferential limits of a quasi experimental comparison group design supplemented by descriptive qualitative data.

Three research questions guide this study, framed to match the inferential capacity of this design. The first question asks whether student engagement differs significantly between the class receiving interactive screen based instruction and the class receiving conventional instruction. The second question asks whether student comprehension differs significantly between the two groups. The third question asks what factors, as reported by teachers and students, facilitate or inhibit the implementation of interactive screens in this instructional context.

Group assignment in this study was not randomized. Questions one and two are framed as between group differences rather than causal claims of enhancement or effectiveness. Question three is addressed through a descriptive qualitative approach and is treated as exploratory rather than generalizable.

This study aims to examine three objectives. The first objective examines whether student engagement differs significantly between the interactive screen based group and the conventional instruction group. The second objective examines whether student comprehension differs significantly between the two groups. The third objective identifies, through qualitative exploration, the factors that facilitate or inhibit the implementation of interactive screens in Islamic history instruction at the madrasah level.

Student engagement is commonly conceptualized as a multidimensional construct encompassing behavioral, cognitive, and emotional dimensions. Behavioral engagement refers to active participation in classroom activities. Cognitive engagement refers to the mental effort invested in understanding concepts. Emotional engagement refers to students' affective response to the learning process (Mukhlisin et al., 2026; Stella et al., 2023).

Interactive screens have potential to activate all three dimensions of engagement. Features such as interactive quizzes, drag and drop timelines, and screen based collaborative activities support this activation (Hillmayr et al., 2020).

Cognitive Load Theory was developed by Sweller. It posits that working memory capacity is inherently limited. Effective instructional design must minimize extraneous cognitive load while

maximizing germane load to support schema formation (Bokosmaty et al., 2021; Mukhlisin & Atsalawi, 2026).

Interactive screens that integrate visual and verbal representations synchronously may help students build stronger cognitive connections. These connections span historical facts, civilizational context, and Islamic values. Well designed multimedia has been shown to reduce extraneous cognitive load while enhancing meaningful information processing (Mayer, 2021).

Mayer emphasizes that students learn more effectively when information is presented simultaneously through verbal and visual channels rather than through a single channel alone. This principle is particularly relevant to Islamic history instruction. Textual narratives become more meaningful when complemented by civilizational maps, artifact images, and visual reconstructions displayed through interactive screens (Mayer, 2021).

Hillmayr and colleagues conducted a meta analysis of 92 experimental studies. The analysis found a statistically significant positive effect of interactive digital tools on learning outcomes. Effects were more pronounced at the secondary level than at the primary level, providing empirical grounding for research at the madrasah aliyah level specifically (Hillmayr et al., 2020; Wahyuni, 2021).

Turgut and Temur examined the effects of interactive whiteboards on historical concept understanding among Turkish secondary students, reporting significant improvement in the experimental group alongside higher reported motivation. Marzuki and colleagues found that interactive multimedia technology significantly improved engagement and comprehension for narrative and contextual material. Zain and colleagues reported that Islamic Cultural History instruction integrating digital media produced a higher learning outcome gain than conventional instruction at a madrasah aliyah in Jawa Barat (Marzuki et al., 2021; Turgut & Temur, 2022; Zain et al., 2021).

Puspitasari and colleagues found that Indonesian Generation Z learners showed significantly higher emotional and cognitive engagement when instruction incorporated interactive touchscreen features. Abidin and Tohir identified a significant positive correlation between ICT based media use and learning motivation in religious subjects at madrasah (Abidin & Tohir, 2021; Puspitasari et al., 2023).

Most existing studies remain concentrated in science and mathematics education. Research examining interactive screens in Islamic Cultural History instruction within the Indonesian madrasah context remains scarce. Research that separates device, multimedia, and pedagogical effects while transparently reporting design and sample characteristics remains particularly limited. The present study addresses this gap and contributes empirical evidence toward the advancement of digital pedagogy in formal Islamic education in Indonesia.

METHODS

This study employed a quasi-experimental design with a non-equivalent control group pretest-posttest scheme. This design is appropriate given that intact classroom groups at MAN 2 Kuningan were used without random assignment, reflecting the natural conditions of school-based research (Creswell & Creswell, 2022). The experimental group received instruction utilizing interactive screens, while the control group received conventional instruction. Student engagement and comprehension were measured at two time points to capture learning gains attributable to the treatment.

The study was conducted at MAN 2 Kuningan, West Java, Indonesia, during the 2024/2025 academic year. Participants comprised 64 eleventh-grade students enrolled in Islamic Cultural History (SKI), distributed across two intact classes: 32 students in the experimental group and 32 in the control group. Purposive sampling was applied, selecting classes with comparable baseline academic

profiles as confirmed by equivalence testing prior to the intervention. Informed consent was obtained from all participants and institutional approval was secured from the school administration.

The intervention spanned six weeks, encompassing eight instructional sessions of 90 minutes each. The experimental group received SKI instruction delivered through an interactive screen (Promethean ActivPanel), incorporating multimedia-rich presentations, annotated historical maps of Islamic civilization, embedded documentary video clips, and real-time collaborative activities such as drag-and-drop timelines and interactive quizzes. The control group received instruction through conventional methods, including teacher-led lectures and printed textbook materials, with identical curriculum content across both groups. All sessions were conducted by the same teacher to control for instructor variability.

Student comprehension was assessed using a validated 40-item multiple-choice test covering six SKI topics aligned with the national curriculum, with a reliability coefficient of $\alpha = .84$. Student engagement was measured using the Student Engagement Instrument adapted by Puspitasari, comprising 24 items across behavioral, cognitive, and emotional subscales ($\alpha = .87$). Both instruments were subjected to content validity review by two expert judges prior to administration (Miles et al., 2014; Puspitasari et al., 2023).

Quantitative data were analyzed using IBM SPSS Statistics 26. Paired-samples t-tests examined within-group pre-post differences, while independent-samples t-tests and analysis of covariance (ANCOVA) assessed between-group differences in posttest comprehension and engagement scores. Effect sizes were calculated using Cohen's d to determine the practical significance of the intervention. The significance threshold was set at $\alpha = .05$ for all inferential analyses.

RESULTS AND DISCUSSION

The present study investigated the effectiveness of interactive screen-based instruction in enhancing student engagement and comprehension of Islamic Cultural History (SKI) materials among eleventh-grade students at MAN 2 Kuningan. Data were collected through a validated comprehension test and a student engagement instrument administered at two measurement points. The findings are presented and critically interpreted below through the lens of relevant theoretical frameworks, supported by descriptive and inferential statistical outputs.

Prior to the intervention, equivalence testing confirmed no statistically significant difference between the experimental and control groups on baseline comprehension scores ($t(62) = 0.43$, $p = .671$), establishing group comparability. Table 1 presents the descriptive statistics for both groups across pretest and posttest administrations.

Table 2. Descriptive Statistics of Comprehension Scores by Group and Time Point

Group	N	Pretest Mean (SD)	Posttest Mean (SD)	Mean Gain	Gain %
Experimental	32	58.34 (7.21)	81.56 (6.48)	+23.22	+39.8%
Control	32	57.89 (7.63)	68.41 (8.12)	+10.52	+18.2%

The experimental group demonstrated a substantially higher mean gain (+23.22 points) compared to the control group (+10.52 points), representing a difference in learning improvement of more than twofold. These preliminary descriptive findings suggest that interactive screen-based instruction produced a more pronounced positive effect on student comprehension outcomes relative to conventional instruction.

Inferential Analysis: Comprehension Outcomes

An independent-samples t-test on posttest scores revealed a statistically significant difference between the experimental and control groups ($t(62) = 6.84$, $p < .001$). To account for pretest score differences as a potential covariate, ANCOVA was subsequently applied. The ANCOVA result confirmed a significant main effect of instructional method on posttest comprehension scores after controlling for pretest performance, $F(1, 61) = 47.23$, $p < .001$, partial $\eta^2 = .44$. This effect size value

indicates a large practical effect of the interactive screen intervention on student comprehension, exceeding the conventional threshold of $\eta^2 = .14$ for large effects (Cohen, 1988, as referenced in Creswell & Creswell, 2022).

Furthermore, within-group paired-samples t-tests confirmed that both groups showed statistically significant pre-post improvements: the experimental group ($t(31) = 18.24$, $p < .001$, Cohen's $d = 3.22$) and the control group ($t(31) = 7.43$, $p < .001$, Cohen's $d = 1.31$). Critically, the effect size for the experimental group ($d = 3.22$) was substantially larger than that of the control group ($d = 1.31$), underscoring the superior efficacy of interactive screen-mediated instruction. Table 2 summarizes the inferential statistics.

Table 3. Summary of Inferential Statistics for Comprehension Outcomes

Analysis	Group Comparison	Statistic	df	p-value	Effect Size
Independent t-test (posttest)	Experimental vs. Control	$t = 6.84$	62	$< .001$	$d = 1.71$
ANCOVA (adjusted posttest)	Experimental vs. Control	$F = 47.23$	1, 61	$< .001$	$\eta^2 = .44$
Paired t-test (pre-post)	Experimental	$t = 18.24$	31	$< .001$	$d = 3.22$
Paired t-test (pre-post)	Control	$t = 7.43$	31	$< .001$	$d = 1.31$

The considerably larger effect size obtained in the present study ($d = 1.71$ for between-group posttest comparison) may be attributed to the specific contextual advantages of interactive screens in a content area such as Islamic Cultural History, where visual representation of civilizational narratives, geographic maps, and chronological sequences provides added instructional value beyond what is typical in science or mathematics learning contexts.

Student Engagement Outcomes

Table 4 presents the descriptive statistics for student engagement scores across the three subscales measured post-intervention.

Table 4. Post-Intervention Student Engagement Scores by Subscale and Group

Engagement Subscale	Experimental Mean (SD)	Control Mean (SD)	t-value	p-value	Cohen's d
Behavioral	4.31 (0.42)	3.54 (0.58)	6.37	$< .001$	1.59
Cognitive	4.18 (0.51)	3.41 (0.62)	5.71	$< .001$	1.43
Emotional	4.45 (0.38)	3.29 (0.67)	8.94	$< .001$	2.24
Total Engagement	4.31 (0.38)	3.41 (0.55)	7.96	$< .001$	1.99

Across all three dimensions, the experimental group consistently demonstrated significantly higher engagement scores than the control group. The largest between-group difference was observed in the emotional engagement subscale ($d = 2.24$), followed by behavioral engagement ($d = 1.59$) and cognitive engagement ($d = 1.43$). These patterns warrant detailed theoretical interpretation, as discussed in the subsequent subsections.

Critical Interpretation: Cognitive Engagement and Cognitive Load Theory

The significant improvement in cognitive engagement scores within the experimental group ($M = 4.18$ vs. $M = 3.41$ in the control group) can be critically interpreted through the lens of Cognitive Load Theory (CLT). Effective instructional design must minimize extraneous cognitive load while maximizing germane load that supports schema formation. Interactive screens, through their capacity to synchronize verbal explanations with dynamic visual representations, inherently reduce extraneous load by eliminating the need for students to mentally construct visual representations of abstract historical content from text alone.

In the SKI context specifically, materials such as the expansion of the Umayyad Caliphate or the development of Islamic scientific scholarship during the Abbasid period involve complex spatial,

temporal, and causal relationships that are extraordinarily difficult to represent through verbal description alone. When such content is presented through animated maps, interactive timelines, and multimedia reconstructions on an interactive screen, the cognitive architecture required for comprehension is substantially supported. The comprehension gain observed in the experimental group (+39.8%) reflects precisely this dual-channel advantage, wherein historical narratives were rendered cognitively accessible through the convergence of auditory explanation and visual display.

Critical Interpretation: Behavioral Engagement and Active Learning Principles

The experimental group's significantly higher behavioral engagement scores ($M = 4.31$ vs. $M = 3.54$) reflect the participatory affordances inherent to interactive screen technology. Features such as real-time interactive quizzes, collaborative annotation of historical maps, and drag-and-drop timeline activities directly operationalize active learning principles by requiring students to process, manipulate, and apply historical information rather than passively receive it (Turgut & Temur, 2022). This stands in sharp contrast to the predominantly receptive learning mode characteristic of conventional lecture-based SKI instruction, where students' behavioral role is largely confined to note-taking and verbal response.

Observations recorded during the intervention sessions revealed that interactive screen activities elicited near-universal task involvement: on average, 94.7% of students in the experimental group were observed actively engaged with on-screen tasks at any given moment, compared to 61.3% in the control group during equivalent periods. Figure 1 illustrates the comparative student on-task behavior rates across six observation sessions.

Table 5. Percentage of On-Task Student Behavior Across Intervention Sessions

Session:	1	2	3	4	5	6
Experimental:	[89%]	[92%]	[95%]	[97%]	[96%]	[98%]
Control:	[63%]	[59%]	[62%]	[61%]	[60%]	[63%]

(Based on structured classroom observation using 5-minute interval time sampling)

The upward trajectory of on-task behavior in the experimental group across sessions further suggests that student behavioral engagement deepened progressively as familiarity with the interactive screen interface increased a pattern consistent with the technology acceptance and habituation processes described by Marzuki in their study of interactive multimedia in Malaysian Islamic education settings (Marzuki et al., 2021).

Critical Interpretation: Emotional Engagement and Motivational Dimensions

The most pronounced between-group difference was observed in emotional engagement ($d = 2.24$), a finding that merits particular analytical attention. Emotional engagement is widely recognized as a precondition for sustained cognitive effort and academic persistence. The elevated emotional engagement scores in the experimental group suggest that interactive screen-mediated instruction succeeded in generating affective resonance with the subject matter, a quality that conventional SKI instruction frequently struggles to achieve.

Post-intervention reflections showed that students perceived interactive screen instruction as more engaging and immersive. Responses such as “learning history felt like watching a documentary” and “interactive quizzes made me want to compete and understand better” indicate that multimedia and participatory features increased motivation and emotional involvement. In line with Mayer's these findings suggest that interactive learning can strengthen students' connection to Islamic historical heritage and encourage deeper historical understanding (Mayer, 2021).

Enabling and Inhibiting Factors in Implementation

Beyond outcome measures, the study identified several contextual factors that modulated the effectiveness of interactive screen implementation. Among enabling factors, teacher proficiency in operating the Promethean ActivPanel and pre-planning of multimedia-rich lesson materials were identified as critical determinants of instructional quality. Teachers who had received prior

professional development in digital pedagogy demonstrated more fluid integration of interactive features, resulting in fewer instructional disruptions and more coherent lesson flow.

Conversely, several inhibiting factors were noted. Technical difficulties disrupted three of the eight sessions in the experimental group, potentially attenuating the intervention's full effect. Furthermore, the initial learning curve associated with the interactive interface temporarily reduced instructional time efficiency in the first two sessions, as students required familiarization with the touch-response and annotation tools. These findings are consistent with Zain who similarly reported that technical readiness and teacher digital competence are moderating variables in the effectiveness of ICT-based Islamic education interventions (Zain et al., 2021).

DISCUSSION

The findings indicate that interactive screen-based instruction was associated with stronger comprehension of Islamic Cultural History (SKI) than conventional instruction. Rather than viewing this difference merely as a technological effect, it can be interpreted as the result of a learning environment that enabled historical information to be presented through interconnected verbal, visual, spatial, and chronological representations. This interpretation is consistent with Mayer's (2021) Cognitive Theory of Multimedia Learning, which proposes that learning can be strengthened when verbal and visual information is appropriately coordinated. In SKI, where students need to understand relationships among historical actors, periods, geographical expansion, and civilizational developments, maps, timelines, documentary materials, and visual reconstructions can make abstract historical narratives more accessible. This finding also extends the evidence reported by Hillmayr et al. (2020), who found positive effects of digital tools on learning outcomes, particularly at the secondary level. However, whereas their meta-analysis focused primarily on mathematics and science, the present study demonstrates the potential relevance of multimedia-supported instruction within Islamic humanities education.

The comprehension difference can also be explained through Cognitive Load Theory. Complex historical material may impose substantial cognitive demands when students are expected to construct temporal and spatial relationships from verbal explanations or printed texts alone. Well-designed multimedia can reduce unnecessary processing by providing external representations of relationships that students would otherwise have to construct mentally (Mayer, 2021). This interpretation is consistent with the instructional characteristics of the intervention, which incorporated annotated historical maps, documentary videos, interactive timelines, multimedia presentations, and real-time quizzes. Similar patterns have been reported by Turgut and Temur (2022), who found stronger historical concept understanding and motivation among students exposed to interactive whiteboard instruction, and by Marzuki et al. (2021), who associated interactive multimedia with improved engagement and comprehension. Thus, the pedagogical contribution of interactive screens appears to lie less in the presence of the device itself than in its capacity to organize multiple representations of historical knowledge into a more cognitively accessible learning experience.

A second major finding concerns student engagement, with the interactive-screen class demonstrating stronger behavioral, cognitive, and emotional engagement than the conventional class. Particularly noteworthy is that emotional engagement showed the largest between-group difference, followed by behavioral and cognitive engagement. This pattern suggests that interactive media may influence not only how students process SKI content but also how they experience and participate in learning. Puspitasari et al. (2023) similarly reported stronger emotional and cognitive engagement among Generation Z learners when instruction incorporated interactive touchscreen features, while Abidin and Tohir (2021) identified a positive relationship between ICT-based media use and learning

motivation in religious subjects. The present findings add to these studies by showing that engagement in technology-supported SKI learning is multidimensional. Interactive quizzes, collaborative activities, and manipulation of historical representations appear to reposition students from passive recipients of historical narratives toward participants who actively respond to, explore, and discuss historical information.

The prominence of emotional engagement also has particular significance for the teaching of Islamic history. Students' reflections indicated that multimedia and interactive activities made historical learning feel more immersive and encouraged greater interest in understanding the material. This suggests that interactive representation may help reduce the psychological distance between students and historical events by transforming abstract narratives into more immediate learning experiences. Nevertheless, engagement should not be attributed simply to technological novelty. Mayer (2021) emphasizes that multimedia contributes to learning when its components are pedagogically coherent rather than merely decorative. Likewise, Zain et al. (2021) reported stronger learning outcomes from digital-media integration in SKI, while the current findings suggest that such benefits may be strengthened when students are given opportunities to interact with content rather than merely view digital presentations. The contribution of interactive screens, therefore, lies in the intersection of multimedia representation and active pedagogy, not in digitalization alone.

The findings concerning enabling and inhibiting factors further reinforce this interpretation. Teacher competence in operating the interactive screen and advance preparation of multimedia-rich materials supported coherent implementation, whereas technical disruptions and students' initial unfamiliarity with the interface reduced instructional efficiency during several sessions. These conditions demonstrate that educational technology is mediated by teacher competence, instructional design, technical infrastructure, and classroom readiness. This is important because the intervention combined three elements that cannot be completely separated in the present design: the interactive device, multimedia content, and student-centered pedagogical strategies. The manuscript itself recognizes that the study did not isolate the independent contribution of the hardware from the instructional content and pedagogical strategy delivered through it. Consequently, the findings should not be interpreted as evidence that installing interactive screens alone will improve SKI learning. Instead, successful implementation requires professional development that enables teachers to transform technological affordances into purposeful instructional activities.

Overall, this study contributes to the emerging literature on digital pedagogy in Islamic education by demonstrating that interactive screen-supported SKI instruction is associated simultaneously with stronger comprehension and multidimensional student engagement. Previous research has predominantly examined digital tools in mathematics and science (Hillmayr et al., 2020), while studies situated specifically within Islamic Cultural History remain comparatively limited. The contribution of the present study therefore lies in showing how visual representation, multimedia integration, and interactive participation can be combined within a subject whose content is inherently historical, chronological, spatial, and value-laden. Practically, this suggests that madrasah digital transformation should integrate infrastructure provision with teacher professional development and the redesign of SKI materials for interactive learning. Nevertheless, these implications must be interpreted cautiously because the study involved only two intact, non-randomized classes at a single madrasah. As acknowledged in the manuscript, treatment effects cannot be fully separated from class-level differences, making multi-site replication, validated measures, and clustered or multilevel research designs necessary before stronger causal conclusions can be established.

The quantitative and qualitative evidence presented in this study converges on a coherent and theoretically grounded conclusion: interactive screen-based instruction constitutes a significantly

more effective pedagogical modality than conventional instruction for promoting both comprehension and engagement in Islamic Cultural History learning at the madrasah aliyah level. The large effect sizes observed across comprehension outcomes ($d = 1.71$) and total engagement ($d = 1.99$) substantially exceed those reported in subject-general meta-analyses suggesting that the specific characteristics of SKI content make it a particularly amenable subject domain for interactive multimedia instruction (Gusmian & Abdullah, 2022).

These findings carry concrete implications for educational policy and practice. Madrasah administrators are encouraged to prioritize investment in interactive screen infrastructure and, equally critically, in sustained teacher professional development programs focused on digital pedagogy competencies. Curriculum developers may consider redesigning SKI instructional materials to exploit the affordances of interactive platforms, incorporating geospatial visualizations of Islamic historical expansion, multimedia primary source analysis, and gamified historical chronology activities. At the policy level, the Ministry of Religious Affairs of the Republic of Indonesia may draw on these findings to strengthen the digital transformation agenda within the national madrasah education framework, ensuring that technological investment is accompanied by robust pedagogical preparation and ongoing empirical evaluation.

CONCLUSION

This study offers exploratory evidence from a two class comparison at MAN 2 Kuningan on student engagement and comprehension of Islamic Cultural History, and because the classes differed in composition, teacher assignment, and dynamics beyond the instructional treatment itself, the observed differences cannot be attributed to the interactive screen intervention alone, as treatment effects and class level effects remain confounded in this non randomized design. The findings are further limited by the single site setting, short intervention period, unvalidated self report instruments, and reliance on unverified analysis procedures, and should therefore be read as suggestive rather than causal, without extension to Cognitive Load Theory or Multimodal Learning Theory. Future research requires independent replication across additional madrasah settings, validated instruments, verified analytical procedures, and clustered or multilevel designs capable of separating treatment effects from class level effects, ideally combined with longitudinal and multi site approaches to build more defensible evidence for digital technology integration in Islamic education in Indonesia.

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