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Transforming *Fiqh* Instruction Through the Cyber Scientific Approach: Enhancing Critical Thinking in Islamic Education

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Abstract

Fiqh learning in Indonesia has traditionally relied on lecture-based instruction rooted in pesantren pedagogy, which often prioritizes knowledge transmission over analytical engagement. This approach, while culturally embedded, poses challenges for cultivating critical thinking skills in 21st-century education. This study introduces the Cyber Scientific Approach (CSA), an instructional model that integrates the scientific method with guided cyber exploration to promote inquiry-based, student-centered learning in Fiqh classrooms. Employing a mixed-methods design, the research involved 60 senior secondary students across three grade levels, combining qualitative data from classroom observations and interviews with quantitative analysis of pre-test and post-test assessments using FRISCO indicators. CSA was implemented through a seven-stage process encompassing Observation, Questioning, Cyber Exploration, Association, Experimentation, Communication, and Conclusion. The findings demonstrate moderate but consistent improvements in students' critical thinking skills across all grades, evidenced by statistical gains and enhanced classroom engagement. This study offers a structured pedagogical framework that aligns the normative foundations of Islamic jurisprudence with contemporary cognitive and digital competencies. It contributes to advancing Islamic education by providing an empirically grounded model for integrating critical thinking and technology in value-laden curricula.

Keywords: *Cyber Scientific Approach; Fiqh Education; Critical Thinking; Islamic Pedagogy; Digital Learning.*

A. Introduction

Critical thinking has emerged as a defining competency of the 21st century, essential for navigating increasingly complex information landscapes, solving real-world problems, and making reasoned, evidence-based decisions (Mahsusi et al., 2024), particularly in learning environments increasingly shaped by digital competence, psychological readiness, and learner autonomy (Nurjannah et al., 2025). No longer considered an innate disposition, critical thinking is now widely recognized within educational discourse as a skill that must be systematically cultivated through pedagogical processes that emphasize inquiry, reflection, and engagement with diverse knowledge sources (Krathwohl, 2002; Voogt & Roblin, 2010), including technology-enhanced and project-based learning approaches that have been shown to strengthen analytical reasoning and problem-solving capacities (Ayu et al., 2025).

Consequently, many national and international curricular frameworks have integrated critical thinking as a core objective in preparing students for the demands of contemporary society (Thornhill-Miller et al., 2023; Nirmala et al., 2025), alongside integrative instructional models such as STEAM education that foster creativity, collaboration, and higher-order thinking skills within both general and Islamic educational settings (Zaqiah et al., 2024; Akmansyah et al., 2025). Despite this global pedagogical shift, integrating critical thinking into subject-specific instruction—particularly in value-laden, normatively anchored disciplines such as Islamic jurisprudence (*Fiqh*)—remains an unresolved and underexplored challenge.

In the context of Indonesian Islamic senior secondary education, the teaching of *Fiqh* remains largely rooted in conventional, teacher-centered pedagogies that closely mirror the traditional *pesantren* model (Haryanti et al., 2023). While this approach has historically succeeded in transmitting doctrinal and textual knowledge, it often limits students' opportunities to engage in analytical inquiry or to contextualize religious principles within contemporary lived experiences (Subuki et al., 2023). As a result, many students perceive *Fiqh* as abstract, difficult to relate to daily realities, and overly reliant on memorization. This perception has been shown to lead to disengagement, a surface-level understanding, and a lack of motivation to critically explore jurisprudential issues (Alkouatli, 2018; Mursalin et al., 2024). Such outcomes illustrate a profound misalignment between instructional methods and the broader educational imperative to cultivate higher-order thinking. More importantly, this misalignment hinders *Fiqh* education from evolving into a pedagogically dynamic, inquiry-driven, and socially responsive field of learning.

Scholarly attempts to address this problem have generally followed two discrete trajectories. The first involves adapting the scientific approach in religious education settings, aiming to introduce more structured, inquiry-oriented methods into Islamic classrooms (Abdullah, 2015; Purwati et al., 2018). The second focuses on integrating digital tools and cyber learning to expand students' access to resources and to facilitate more interactive, learner-centered environments (Aljawarneh, 2020; Guentulle et al., 2024), particularly within the broader transformation of madrasah and Islamic educational institutions facing globalization and internationalization pressures (Supriyanto et al., 2025). While both directions represent important advances, they remain conceptually and methodologically fragmented.

The application of the scientific approach in Islamic education, for example, often lacks sensitivity to the unique epistemological foundations and normative demands of *Fiqh*, which are deeply rooted in maqāṣid-oriented reasoning and contextual jurisprudential interpretation (Arief et al., 2025; Sukron et al., 2025). On the other hand, studies exploring digital integration tend to prioritize technological access and platform usability rather than designing coherent pedagogical models that foster systematic critical thinking, professional competence, and reflective reasoning among teachers and learners in Islamic education contexts (Oviyanti et al., 2025; Enes et al., 2024). Furthermore, the literature reveals a scarcity of comprehensive frameworks that integrate scientific inquiry, digital literacy, and jurisprudential reasoning into a unified, pedagogically coherent strategy for *Fiqh* instruction, despite growing empirical attention to socio-religious practices and legal reasoning in diverse Muslim communities (Mansur et al., 2024; Tengku Kasim et al., 2024). This fragmentation constitutes a clear research gap: the absence of an instructional model that is simultaneously technologically integrated, epistemologically grounded, and tailored to the normative structure of Islamic legal education, particularly within contemporary Islamic higher education and post-conflict Muslim societies (Barus et al., 2024).

To address the identified pedagogical gap, this study introduces the Cyber Scientific Approach (CSA), a structured instructional framework designed specifically for *Fiqh* education. Unlike previous efforts that merely juxtapose scientific methods with digital platforms, CSA presents an integrated seven-stage pedagogical sequence—Observation, Questioning, Cyber Exploration, Association, Experimentation, Communication, and Conclusion. This sequence is intended to guide students systematically through critical inquiry while remaining anchored in the epistemological foundations of Islamic

jurisprudence (Tawafak et al., 2020). Theoretically, CSA draws upon three intersecting domains: critical thinking theory, constructivist pedagogy, and digital literacy. The convergence of these domains positions CSA not merely as a technique but as a pedagogical orientation that reframes *Fiqh* from a static body of legal rulings into a dynamic field of contextual interpretation and analytical engagement.

In building this framework, the study responds to persistent tensions within Islamic pedagogy—particularly the perceived incompatibility between normative religious instruction and the cultivation of critical thinking. Through empirical analysis of CSA implementation in *Fiqh* classrooms, this research demonstrates that inquiry-based learning and cyber-mediated exploration can be integrated meaningfully into religious education without compromising theological integrity. Rather than presenting CSA as an isolated innovation, the study shows how its structured design can serve as a pedagogical bridge: mediating between traditional authority and student-centered learning, and enabling the coexistence of doctrinal fidelity with reflective inquiry. In doing so, the findings offer both a theoretical clarification and a practical alternative to the didactic, rote-based models that continue to dominate *Fiqh* instruction.

Accordingly, the purpose of this study is twofold: to explore the implementation of CSA within real classroom settings and to assess its effectiveness in enhancing students' critical thinking skills. Employing a mixed-methods approach, the study integrates qualitative insights from observations and interviews with quantitative data from pre- and post-test assessments, which are analyzed using the FRISCO indicators of critical thinking. This dual-method design not only strengthens the empirical rigor of the research but also facilitates a more holistic understanding of how CSA operates in practice.

Ultimately, the study seeks to contribute to the broader renewal of Islamic education by offering a pedagogically coherent, context-sensitive model that aligns religious instruction with the cognitive and technological demands of contemporary learners. While rooted in the Indonesian context, the conceptual and instructional implications of this model resonate more broadly, offering potential insights for modernizing religious education systems across diverse cultural and institutional settings—without sacrificing their normative commitments.

B. Method

This study employed a mixed-methods research design to investigate the implementation and effectiveness of the Cyber Scientific Approach (CSA) in *Fiqh*

instruction. Combining qualitative and quantitative data allowed for a comprehensive understanding of both the instructional process and its outcomes, particularly in relation to the development of students' critical thinking skills (Creswell, 2013). The qualitative strand captured classroom interactions and participant experiences, while the quantitative strand measured pre- and post-intervention changes in performance, enabling methodological triangulation.

The research was conducted at MAN 1 South Tangerang City, Indonesia, between May and July 2023. The participants consisted of 60 senior secondary students from Grades 10 to 12 (32 male and 28 female), selected purposively based on their active enrollment in *Fiqh* classes, baseline digital literacy, and access to internet-enabled devices. The chosen school represented a typical urban Islamic institution with adequate infrastructure to support the full integration of CSA.

Data collection followed three aligned procedures. First, structured classroom observations were conducted across the entire intervention cycle to monitor the enactment of the seven CSA stages: Observation, Questioning, Cyber Exploration, Association, Experimentation, Communication, and Conclusion. Second, semi-structured interviews were held with the *Fiqh* teacher and a representative sample of students to explore their perceptions of the CSA experience, its challenges, and its pedagogical relevance (Creswell & Poth, 2018). Third, students completed pre-test and post-test assessments based on FRISCO indicators of critical thinking (Ennis, 2015), which provided a framework for measuring gains in focus, reasoning, inference, and clarity.

Qualitative data were analyzed thematically using the phased approach developed by Braun and Clarke (2006), including familiarization, coding, theme development, and interpretation. A deductive coding scheme based on FRISCO was used, while emergent themes were allowed to surface inductively. Credibility of the findings was ensured through triangulation of data sources and member checking (Lincoln & Guba, 1985).

Quantitative data were analyzed using SPSS version 29. A paired-sample *t*-test was used to assess statistical significance between pre- and post-test scores. The degree of improvement was further evaluated through normalized gain (*n*-gain) using the formula: *n*-gain = (post-test score − pre-test score) / (maximum score − pre-test score) (Hake, 1999). Interpretation was based on established thresholds: low (<0.3), moderate (0.3–0.7), and high (>0.7).

The research adhered to established ethical protocols, including informed consent, voluntary participation, anonymity, and the right to withdraw at any stage.

Figure 1 below presents an overview of the research procedure, illustrating the sequential phases from design and data collection to analysis and interpretation.

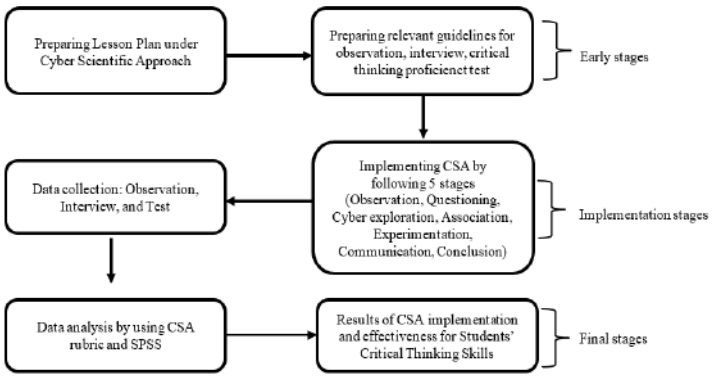

Figure 1. Research procedure flowchart

C. Results and Discussion

This section presents the study's findings in accordance with the research objectives, which aim to evaluate the implementation and effectiveness of the Cyber Scientific Approach (CSA) in enhancing students' critical thinking skills in *Fiqh* education. The results are structured into two major parts: (1) the Results section, which objectively reports quantitative data and field-based evidence obtained through tests, observations, and interviews without interpretive analysis; and (2) the Discussion section, which interprets the significance of the findings in light of the study's conceptual framework, relevant literature, and practical implications. This structure ensures a clear distinction between empirical facts and analytical insights, while also allowing a coherent transition from data presentation to academic reflection. The combination of both qualitative and quantitative findings provides a comprehensive account of how CSA fosters critical thinking across multiple dimensions of classroom interaction and student performance.

1. Results

To assess the impact of the Cyber Scientific Approach (CSA) on students' critical thinking skills, the study employed a paired-samples t-test to compare pre-test and post-test scores across three grade levels. The statistical analysis revealed a significant increase in students' performance following the implementation of CSA ($p < .05$), indicating that the intervention had a measurable effect across all observed groups. To further examine the extent of improvement, the study calculated normalized gain (n-

gain) scores, which provide a standardized measure of learning gains by accounting for students' initial performance. These scores were then categorized based on established benchmarks to determine the level of effectiveness achieved.

As summarized in Table 1, the results show a consistent upward trend in critical thinking performance across both implementation cycles. Notably, Class X recorded the highest improvement with an n-gain of 0.6, followed by Class XI (0.5) and Class XII (0.4), all within the moderate category—suggesting that CSA had a meaningful and consistent pedagogical impact across diverse student cohorts. The detailed figures in the table below clearly depict this progression.

Table 1: Pre-Test, Post-Test, and Normalized Gain (n-gain) Scores by Class

Class	Cycle	Pre-Test (Avg)	Post-Test (Avg)	n-gain	Category
Class X	1	71.2	88.5	0.6	Moderate
	2	82.6	95.6		
Class XI	1	69.7	85.3	0.5	Moderate
	2	81.4	87.6		
Class XII	1	65.5	78.0	0.4	Moderate
	2	88.3	94.8		

To complement the numerical summary, the trend of improvement is also visually illustrated in Figure 1. This bar graph highlights the comparative average scores of the experimental classes before and after CSA implementation across two cycles for each grade level. The consistent upward trajectory across all groups further affirms the positive influence of CSA in fostering students' critical thinking. Notably, the highest post-test average (95.6) was recorded in the second cycle of Class X, suggesting that CSA's effectiveness may increase with repeated exposure and familiarity with the model.

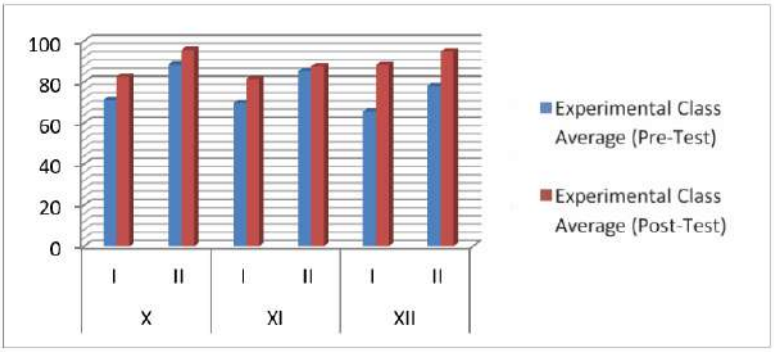

Figure 1: Average Pre-Test and Post-Test Scores for the Experimental Class

a. Qualitative findings on CSA Implementation and engagement

Qualitative findings were obtained through classroom observations and semi-structured interviews, and were then analyzed thematically to align with the seven instructional stages of the Cyber Scientific Approach (CSA). These findings illustrate students' behavioral engagement, cognitive processes, and performance patterns across each phase, grounded in the FRISCO indicators of critical thinking.

1) Stage 1: Observation (focus)

During the initial stage, students were encouraged to observe real-life phenomena within their social and cultural environments and identify problems relevant to *Fiqh*. The majority of students showed readiness in documenting contextual cases derived from community behavior and digital sources. For instance, one student noted, *"I have documented what I observed about the habits of people in my community and found similar information online; this can be categorized as a problem"* (Interview with Student, June 6, 2023). Observational field notes also confirmed that students demonstrated curiosity and were actively involved in identifying relevant legal-ethical issues.

However, teachers observed a lack of variety in the themes selected. According to one teacher, *"Most groups identified similar issues, resulting in a lack of diversity in the events being investigated, such as frequent selection of buying and selling practices at local markets or mismanagement of zakat distribution"* (Interview with Teacher, June 6, 2023). This pattern highlights the need to encourage broader exploratory thinking in early-stage observation.

2) Stage 2: Questioning (focus)

In this phase, students were tasked with formulating research questions based on the problems they had observed. While some students succeeded in developing inquiry-based questions, many struggled to construct clear, hypothesis-driven formulations. A student explained, *"I posed a simple question, but the problem remains unanswered clearly when I only receive responses from my peers"* (Interview with Student, June 8, 2023). This indicates a gap in students' ability to scaffold inquiry without direct teacher facilitation.

Teachers provided scaffolding throughout the stage. One teacher remarked, *"Students often reformulate their questions after receiving feedback, but some are still unclear about the difference between descriptive and analytical questions"* (Interview with Teacher, June 8, 2023). This difficulty suggests the importance of modeling question development during instruction.

3) Stage 3: Cyber exploration (reason)

In the exploration phase, students were guided to gather digital resources that could support the analysis of their questions. Observation records noted high student engagement with online platforms. An entry from field notes stated, "*All students opened laptops, with some utilizing mobile devices to gather information on jurisprudential themes*" (Observation, June 8, 2023). Students demonstrated growing digital confidence and autonomy.

Students confirmed their comfort with the process. One student shared, "*I easily search online for various information about the topic we are studying, especially how scholars explain inheritance or contemporary issues like online transactions*" (Interview with Student, June 6, 2023). Teachers appreciated this phase as a space for digital literacy development, but remained cautious. A teacher reflected, "*Some students rely heavily on blog posts and unverified content; we must constantly teach them how to verify information and cite reputable sources*". (Interview with Teacher, June 8, 2023)

4) Stage 4: Association (inference, situation)

This stage required students to link gathered information with their formulated questions, assess credibility, and identify patterns or inconsistencies. Many students showed progress in connecting evidence with the initial problem, but they struggled in critically selecting relevant information.

A student admitted, "*Choosing data that supports the questions is quite challenging due to the overwhelming amount of information available on the internet. I found many conflicting views on a single issue*" (Interview with Student, June 6, 2023). Teachers also noted this challenge. One explained, "*Students begin to realize the complexity of selecting strong arguments, especially when they have to evaluate multiple interpretations in Fiqh texts*". (Interview with Teacher, June 6, 2023)

Some students demonstrated early inferential reasoning but needed support to develop more structured conclusions. As another student reflected, "*When reading different opinions, I try to look at the context and decide which one makes more sense with the problem we face*". (Interview with Student, June 6, 2023)

5) Stage 5: Experimentation (clarity)

This phase allowed students to translate their understanding into tangible digital outputs, such as infographics, short videos, and simple applications. Students responded creatively, integrating legal reasoning into digital forms. One student noted,

"Presenting the results is easy, but it requires significant time. We created a visual diagram for inheritance calculation, which took days to refine" (Interview with Student, June 14, 2023).

Teachers observed variations in students' abilities to clearly communicate their findings. A teacher stated, *"Some students created PowerPoint presentations, while others went further by making prototypes or using Canva and animation tools. I encouraged them to choose formats that help clarify their ideas"* (Interview with Teacher, June 14, 2023). This stage was also instrumental in developing clarity in articulation and technical creativity.

6) Stage 6: Communication (overview)

Students engaged in presenting their group results to the class and participated in peer feedback sessions. This process fostered a communicative classroom culture in which students refined their arguments through feedback. One student remarked, *"We received valuable appreciation and feedback from other groups, and some of their questions helped us improve our thinking"*. (Interview with Student, June 14, 2023)

Teachers confirmed this observation. *"Students can accept responses from their peers and actively engage in Q&A during the presentation process. Their ability to explain their ideas is improving each time they communicate their work"* (Interview with Teacher, June 14, 2023). This stage was essential in building reasoning fluency and confidence.

7) Stage 7: Conclusion (overview)

The final stage required students to draw logical conclusions aligned with their initial observations and questions. Students were encouraged to synthesize their learning outcomes, compare findings with earlier assumptions, and determine their position. One student explained, *"We conclude whether our findings align with our initial hypotheses, weighing the arguments and evidence. Sometimes, our results go in a different direction, but we explain why"* (Interview with Student, June 14, 2023). The teacher guided students to finalize their reflections, stating, *"I help students reach a specific and objective conclusion that reflects their group's analytical process, not just repeating the problem"*. (Interview with Teacher, June 14, 2023)

This stage strengthened students' reflective thinking and helped consolidate their understanding of the inquiry cycle. It served as the capstone for translating critical thinking indicators into observable academic outcomes through CSA.

b. Integration of findings

The integration of quantitative and qualitative data offers a comprehensive picture of the Cyber Scientific Approach's (CSA) effectiveness in enhancing students' critical thinking skills. Improvements in pre-test and post-test scores across all three grade levels not only demonstrate statistically significant learning gains but also correspond directly with patterns of behavioral engagement observed during classroom activities. These patterns were consistently aligned with the FRISCO critical thinking indicators—Focus, Reason, Inference, Situation, Clarity, and Overview—which were systematically embedded within each phase of the CSA model.

Throughout the seven instructional stages, students were observed to gradually shift from passive recipients of knowledge to active participants in inquiry-based learning. In the initial stages, such as Observation and Questioning, students showed increasing awareness of their surroundings and developed the ability to articulate relevant problems, albeit with some guidance. As the process continued into Cyber Exploration and Association, their capacity to seek out, organize, and relate information began to improve, even as challenges emerged in evaluating the quality and credibility of sources. The transition from gathering information to producing digital artifacts during the Experimentation stage marked a significant point of cognitive engagement, where students demonstrated not only an understanding of *Fiqh* content but also the ability to creatively apply it through digital tools.

This cognitive and behavioral progression was most evident in the final stages—Communication and Conclusion—where students communicated findings using multimedia tools and engaged in peer feedback sessions. Here, students displayed greater confidence in reasoning and were able to synthesize findings into structured conclusions. Their ability to respond to questions, clarify arguments, and justify conclusions was particularly noted by teachers as a major improvement compared to pre-intervention classroom norms.

Notably, the convergence between quantitative learning gains and qualitative classroom behaviors underscores the internal consistency of the findings. For instance, classes with higher *n*-gain scores also exhibited stronger student autonomy and more diverse project outputs, as reflected in both interview data and teacher observations. This suggests that the CSA's sequential structure plays a vital role not only in organizing instruction but in reinforcing critical thinking behaviors gradually and cumulatively. Moreover, the observed consistency in engagement across all student

groups—despite variations in digital literacy and initial academic performance—demonstrates CSA's adaptability and scalability across diverse classroom contexts.

In summary, the cross-validation between test scores and classroom behaviors affirms that the CSA model successfully operationalizes critical thinking into concrete, observable learning practices. The seven-stage framework not only structures inquiry in a manageable format but also ensures that each cognitive indicator is practiced, reinforced, and eventually internalized by students. These results position CSA as a methodologically grounded and pedagogically sound model for promoting critical thinking in Islamic education settings.

2. Discussion

The implementation of the Cyber Scientific Approach (CSA) in *Fiqh* education, as explored in this study, provides compelling evidence for its effectiveness in enhancing students' critical thinking skills through a structured, inquiry-based model grounded in both pedagogical rigor and epistemological sensitivity. The results demonstrated moderate yet consistent improvement across grade levels, as evidenced in significant increases in pre- and post-test scores and qualitative shifts in student engagement and reasoning across the seven CSA stages. These empirical patterns offer a solid foundation for interpreting CSA not merely as a local pedagogical experiment, but as a theoretically grounded and potentially scalable model for religious instruction in the digital era.

Theoretically, the seven-stage progression of CSA—Observation, Questioning, Cyber Exploration, Association, Experimentation, Communication, and Conclusion—provides a systematic operationalization of the FRISCO framework of critical thinking within the specific context of *Fiqh* learning. In the early stages, students developed focus through problem identification, resonating with Ennis's (1989) conception of critical thinking as a process of clarifying and articulating issues. During Cyber Exploration and Association, students engaged in reasoning and inference, consistent with literature that emphasizes the role of cross-source analysis in nurturing higher-order thinking (Battersby, 2016; Indrašienė et al., 2018). As students progressed to Experimentation and Communication, they demonstrated growing clarity and the ability to communicate reasoned conclusions, aligning with Ennis's (2015) and Mulnix's (2012) emphasis on expression and justification as integral to critical thinking.

Importantly, CSA's structured yet flexible design bridges established gaps in the literature on Islamic education. Prior research has affirmed the benefits of scientific

inquiry in religious learning (Abdullah, 2015; Purwati et al., 2018), yet often without offering a systematic model suited to normative disciplines such as *Fiqh*. Simultaneously, studies on cyber pedagogy have largely emphasized digital access (Higgins, 2014; Aljawarneh, 2020; Lubis et al., 2024) without addressing the integration of such tools into epistemologically coherent frameworks. The CSA model advances this discourse by unifying scientific inquiry and digital exploration in a pedagogical sequence that is explicitly sensitive to the epistemic and moral contours of Islamic jurisprudence. The findings thus not only validate CSA as an effective model but also situate it within a broader conversation on how religious education can evolve while retaining its doctrinal integrity.

The distinct contribution of CSA lies in its ability to integrate three critical yet often segregated dimensions of instructional design: inquiry-driven pedagogy, structured digital engagement, and the epistemological foundations of *Fiqh* (Naisabur et al., 2024; Arief et al., 2025; Sukron et al., 2025). Rather than treating technology as an external addition to traditional instruction, CSA embeds digital tools meaningfully into each instructional phase, ensuring they function as cognitive supports that enhance—not dilute—the depth of student learning (Supriyanto et al., 2025; Enes et al., 2024). This intentional integration is evident in how students engaged with cyber resources during the exploration phase, treating them not simply as sources of information but as instruments for questioning, evaluating, and synthesizing knowledge (Mansur et al., 2024; Tengku Kasim et al., 2024). At the same time, the CSA framework remains firmly grounded in the normative logic of Islamic jurisprudence, guiding students to arrive at conclusions through structured analysis and evidence-based reasoning (Sukron et al., 2025; Arief et al., 2025). This balanced and coherent design marks a significant pedagogical development, offering educators a framework that is both responsive to contemporary educational demands and aligned with the intellectual traditions of *Fiqh* (Oviyanti et al., 2025; Barus et al., 2024).

From a practical standpoint, CSA offers a highly adaptable framework for transforming *Fiqh* instruction from teacher-centered exposition to student-centered inquiry (Thoyib et al., 2024; Arodha et al., 2025). The consistent improvements in n-gain scores across grade levels underscore its replicability, while variations in student responses reveal the model's flexibility to accommodate different levels of digital literacy, prior knowledge, and learning styles, including those shaped by emerging digital assessment and feedback practices in Islamic education (Putri et al., 2025).

Teachers reported increased student autonomy, richer classroom discussions, and more dynamic presentation formats, indicating that CSA stimulates a shift in classroom culture alongside individual learning gains. Moreover, by integrating FRISCO indicators at each stage, CSA enables teachers to monitor and support students' critical thinking development in real time, thereby enhancing instructional responsiveness and formative assessment (Ennis, 2015; Hake, 1999).

CSA's significance extends beyond its immediate instructional outcomes. The model addresses a systemic challenge in Islamic education: the need to reconcile the transmission of religious knowledge with the cultivation of analytical and reflective skills. In many Muslim-majority contexts, *Fiqh* instruction remains dominated by memorization and textual recitation, often disconnected from students' lived realities and contemporary challenges (Haryanti et al., 2023; Subuki et al., 2023). CSA counters this tendency by situating jurisprudential concepts within authentic problems drawn from students' environments and encouraging them to navigate these issues through structured inquiry and digital investigation. This pedagogical approach repositions *Fiqh* not as a static set of rules, but as a living discipline open to engagement, interpretation, and ethical reasoning (Alkouatli, 2018; Akmansyah et al., 2025).

Furthermore, the findings of this study are particularly relevant in light of ongoing global discussions on education in the 21st century. As educational systems worldwide strive to integrate critical thinking, digital competence, and contextual relevance into curricula (Voogt & Roblin, 2010; Thornhill-Miller et al., 2023), models like CSA offer concrete examples of how these goals can be achieved in religious education without compromising its normative foundations. The implications are especially pertinent in the Global South, where religious schools play a central role in shaping not only students' intellectual formation but also their ethical and civic identities (Mahsusi et al., 2024). CSA's success in an Indonesian Islamic senior high school demonstrates its potential adaptability to similar institutional settings across Southeast Asia, the Middle East, and beyond.

The international relevance of CSA also lies in its methodological clarity. By offering a clearly defined instructional sequence with identifiable stages, the model provides educators and researchers in other countries with a blueprint that can be adapted, tested, and refined according to local needs. The structured progression aligns well with international standards for competence-based learning and can help bridge the gap between religious instruction and global educational benchmarks

(Thoyib et al., 2024; Putri et al., 2025; Doll Kawaid et al., 2025; Arodha et al., 2025). This positions CSA not as an isolated innovation, but as a globally relevant framework that contributes to a more nuanced understanding of how tradition-based disciplines can evolve pedagogically in response to contemporary demands (Tolu & Evans, 2012; Manishimwe et al., 2023).

Despite its promise, several limitations of the present study warrant acknowledgment. The research was conducted in a single urban institution with strong digital infrastructure, which may not be representative of all Islamic schools, particularly those in rural or under-resourced areas. The effectiveness of CSA may depend on contextual variables such as teacher training, student familiarity with technology, and institutional support. Additionally, the study did not track long-term retention of critical thinking skills or their transferability to other subjects. These limitations suggest the need for further research across diverse settings, including longitudinal studies to evaluate the sustainability of learning gains and comparative research to test CSA's efficacy against other pedagogical models.

Finally, the study affirms the Cyber Scientific Approach as a viable and theoretically grounded method for fostering critical thinking in *Fiqh* education. By integrating inquiry-based learning, digital literacy, and normative religious epistemology into a coherent instructional framework, CSA redefines the pedagogical possibilities for Islamic education. It empowers students to move beyond memorization toward critical engagement with jurisprudential issues and equips educators with a structured model for cultivating 21st-century competencies within traditional disciplines. While contextual adaptation and further empirical validation are necessary, CSA represents a meaningful step toward a more reflective, dialogical, and globally responsive model of religious instruction.

D. Conclusion

This study has demonstrated that the Cyber Scientific Approach (CSA) is an effective, contextually grounded pedagogical model for fostering critical thinking in the domain of *Fiqh* education. By combining structured scientific inquiry with ethically framed cyber exploration, CSA repositions *Fiqh* learning from a predominantly teacher-centered, text-reliant tradition toward an interactive, student-driven process that cultivates higher-order thinking. The evidence, drawn from both quantitative and qualitative strands, confirms that students not only improved across FRISCO-based indicators but also engaged more meaningfully in problem

identification, digital reasoning, and reflective articulation. These gains, though moderate, were consistent across different grade levels, reaffirming the model's pedagogical coherence and practical relevance.

The central contribution of this study lies in articulating a replicable instructional framework that bridges the epistemological commitments of Islamic jurisprudence with the methodological demands of 21st-century education. Unlike piecemeal technological interventions or generic inquiry strategies, CSA offers a deliberately staged learning process that is sensitive to both religious norms and cognitive development. In doing so, it provides educators with a concrete model for transforming value-laden subjects into intellectually rigorous and contextually relevant learning experiences. This positioning of CSA—at the intersection of tradition, technology, and critical pedagogy—marks a significant step in rethinking religious instruction in a digitally connected era.

Building on the acknowledged limitations, this study also opens several avenues for future research. Longitudinal studies are needed to explore the sustainability and transferability of students' critical thinking skills across disciplines and over time. Expanding CSA implementation across more diverse educational environments, including rural, cross-national, and interfaith contexts, would further test its adaptability and cultural scalability. Additionally, developing more comprehensive teacher support systems and digital scaffolding tools will be essential for ensuring equitable access and consistent instructional quality. Extending CSA's application to other normative domains within Islamic education—such as theology, ethics, or interreligious dialogue—may also broaden its transformative potential.

Ultimately, CSA affirms that critical thinking and religious tradition are not only compatible but can be mutually reinforcing when anchored in pedagogical intentionality and inquiry-based design. As Islamic education continues to evolve amid global educational shifts, CSA offers a principled yet progressive approach for cultivating learners who are not only intellectually competent but also ethically grounded and digitally literate.

Declaration of Competing Interest

The authors declare that they have no known competing financial or non-financial interests that could have appeared to influence the work reported in this paper.

Declaration of Generative AI

The authors affirm that the preparation of this manuscript involved the use of AI-based writing support tools, specifically Grammarly and Quillbot, for grammar checking and language refinement. These tools were employed solely to enhance linguistic clarity and coherence; all intellectual content, interpretations, analyses, and conclusions presented in the manuscript are the original work of the authors.

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