Pakistan Journal of Criminology
Vol. 16, No. 04, October—December 2024 (1271-1283)

The "Kaffah" Science Learning Model: Integrating Science with Religion to Enhance Student Metacognition

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Abstract

This research investigates the effectiveness of the "Kaffah" Science learning model in enhancing metacognitive skills among teacher education students. Following an experimental design with a sample of 100 participants from Mataram State Islamic University, the study employs pre-test and post-test measures to assess metacognition before and after implementing the model. Results reveal significant improvements across various metacognitive levels, with a moderate normalized gain. The Kaffah Science model, rooted in the principle of 'kaffah,' integrates science with religion, emphasizing exploration, meaningfulness, and reflective practice. Validation of instruments, including learning tools and metacognition questionnaires, ensures data credibility. Student responses underscore the model's effectiveness, ease of comprehension, and positive emotional experiences. This research contributes to the ongoing discourse on pedagogical innovation, highlighting the Kaffah Science model as a comprehensive and holistic educational framework for integrating science and religion to enhance metacognitive skills.

Keywords: Kaffah Science learning model, metacognition, science and religion, exploration, meaningfulness, reflective practice, holistic education.

Introduction

In the dynamic landscape of contemporary education, the quest for innovative and effective pedagogical models is ever evolving. As educators and researchers strive to enhance students' learning experiences, integrating various disciplines has emerged as a promising avenue for fostering holistic development. This research article delves into the Kaffah Science learning model, a novel approach that intertwines science and religion to elevate student metacognition.

The integration of science and religion in education is a concept that has been introduced previously (Hutchinson, 1991). Throughout history, various cultures have recognized the interconnectedness of these domains, acknowledging that both contribute to a more profound comprehension of the universe. However, in contemporary educational discourse, this integration has been met with skepticism and apprehension (Harrison, 2017). This research seeks to address these concerns by exploring the potential of the Kaffah Science learning model to harmoniously blend scientific inquiry with religious principles, providing a nuanced and balanced perspective for students. One of the critical foundations of

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the Kaffah Science Learning Model is the acknowledgment that science and religion, at their core, share a common goal of pursuing knowledge and understanding (Brooke, 2014). By embracing this shared objective, educators can guide students toward synthesizing scientific and religious principles, fostering a mindset that appreciates the complementary nature of these seemingly disparate fields. The overarching hypothesis of this research is that such an integrated approach can lead to improved metacognitive skills among students as they learn to navigate and reconcile diverse perspectives.

To contextualize the Kaffah Science learning model within the broader landscape of educational theory, it is essential to examine the current state of science education and its inherent challenges (National Research Council, 2012). Traditional science instruction often prioritizes the delivery of information, sometimes neglecting the cultivation of higher-order thinking skills (Lubna et al., 2023; Suhirman & Prayogi, 2023). Moreover, the compartmentalization of science and religion in educational settings can contribute to a fragmented worldview, hindering students from grasping the interconnectedness of knowledge (Barbour, 2000). In contrast, the Kaffah Science learning model departs from this compartmentalized approach by intertwining science with religious teachings. This integration is intended to maintain the scientific rigor of the curriculum but rather to enhance it by providing students with a more comprehensive and interconnected understanding of the material.

The religious component of the Kaffah Science learning model draws inspiration from Islamic religious traditions. Through empirical investigation and analysis, we aim to shed light on the potential impact of this innovative model on student metacognition and, by extension, on the broader landscape of science education. Ultimately, this research contributes to the ongoing dialogue surrounding pedagogical innovation in science education. Specifically, the current study aims to implement the Kaffah Science learning model to improve students' metacognition skills.

Literature Review

The Kaffah Science learning model is rooted in the principle of 'kaffah,' an Arabic term signifying completeness and wholeness (Bujuri et al., 2020). This model seeks to provide a comprehensive educational framework that imparts scientific knowledge and integrates religious perspectives, thereby fostering a holistic understanding of the world. In a time when the intersections between science and religion are often viewed as conflicting, the Kaffah Science learning model aims to bridge this perceived gap and create a symbiotic relationship that enriches the learning experience. The Kaffah Science learning model is developed based on principles that involve connecting scientific concepts with religion, applying them through exploration and experimentation, and emphasizing their meaningfulness in everyday life (Ayub et al., 2023). Exploration aspects are highlighted, primarily referring to science problems and projects, so combining

these principles makes Kaffah Science a holistic learning model. These principles form the foundation for constructing the Kaffah Science learning model, organized in the sequence of general learning phases, which include the orientation of science in the context of religion, exploration and experimentation, and conclusion (reflection on learning activities) (Ayub et al., 2023).

Integrating the Kaffah Science learning model, which comprises three distinct phases – orientation of science in the context of religion, exploration and experimentation, and concluding reflection on learning activities – presents a unique and dynamic approach to science education. The orientation phase sets the foundation by linking scientific concepts with religious perspectives, providing students with a holistic understanding of the subject. Research indicates that incorporating religious perspectives into science education fosters a sense of completeness and enhances students' cognitive engagement and thinking skills (Chan et al., 2023; Ningsih et al., 2022). By acknowledging the interconnectedness of science and religion, students are encouraged to approach scientific inquiry with a broader worldview, promoting a more nuanced understanding of the material (Purwati et al., 2018).

The exploration and experimentation phase of the Kaffah Science learning model further contributes to improving students' thinking skills and metacognition. This phase emphasizes hands-on learning experiences and project-based activities, allowing students to engage with scientific principles in real-world contexts actively. Studies have shown that the practical application of scientific concepts through experimentation enhances students' problem-solving abilities and thinking skills (Cheng et al., 2017; Ekayanti et al., 2022; Salvetti et al., 2023). Moreover, exploring encourages students to ask questions, seek solutions, and draw connections between scientific principles and religious teachings. This active involvement in the learning process deepens their understanding and cultivates metacognitive awareness as students reflect on their own thinking processes and learning experiences (Akben, 2020). Therefore, the dynamic combination of these learning phases in the Kaffah Science model contributes to a more comprehensive and practical approach to improving students' metacognition in science education.

Metacognition, often defined as thinking about one's thinking processes, has gained prominence in educational research as a pivotal factor in student learning outcomes (Flavell, 1979). Reflecting on and regulating one's cognitive processes is integral to fostering deep understanding, critical thinking, and lifelong learning (Benade, 2015; Sun et al., 2022; Verawati et al., 2021). Metacognition is one of the innovative learning skills of the 21st century, which involves high-level cognitive processes, including thinking about knowledge and how to obtain knowledge through a reflective process (Muhali et al., 2019). Recognizing the significance of metacognition in the educational landscape, this study explores how the Kaffah Science learning model can catalyze improving metacognitive skills among students.

Method

The research adopts a quantitative approach with an experimental design to investigate the efficacy of the "Kaffah" Science learning model in enhancing students' metacognitive skills. The experimental design allows for the manipulation of independent variables to observe their effects on the dependent variable, metacognitive skills, in this context. The study employs a pre-test and post-test design, measuring metacognition skills before and after implementing the "Kaffah" Science learning model. This design facilitates the assessment of the model's impact on the participants' metacognitive abilities over a specific period.

The study involves 100 participants, specifically teacher education students at Mataram State Islamic University. The participants are categorized into three groups—A, B, and C- Through classical grouping. Group A comprises 29 participants, three males, and 26 females; Group B shall consist of 35 participants, four males, and 31 females; and Group C includes 36 participants, eight males, and 28 females. The choice of participants from teacher education students ensures relevance to the research focus on integrating science with religion in the learning process. This sample size and categorization aim to provide a robust understanding of the "Kaffah" Science learning model's impact on diverse groups within the target population.

Results

A study that applies the Kaffah Science learning model to improve students' metacognition skills has been conducted. The results of the pretest and posttest analysis are presented in Figure 1.

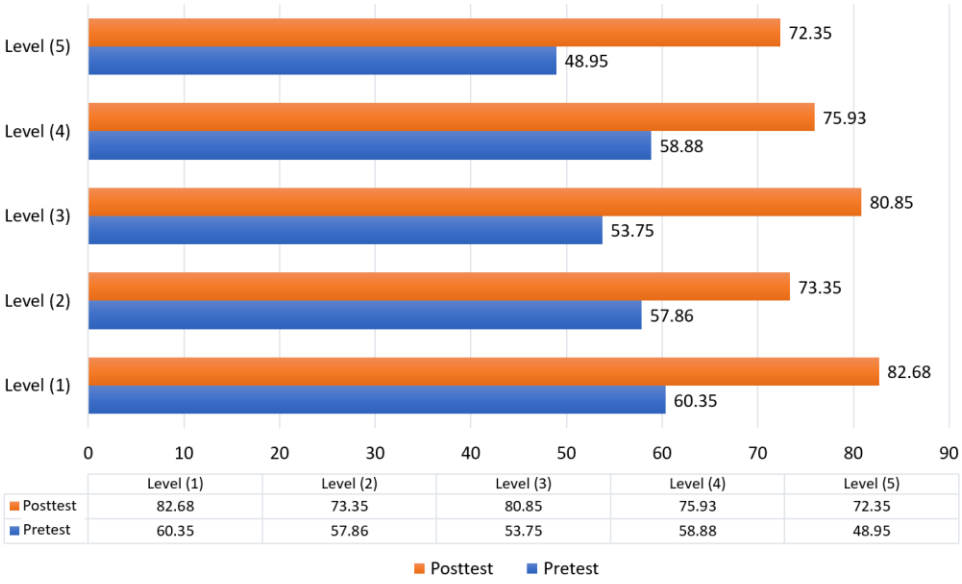

Figure 1. Results of pretest and posttest analysis of students' metacognitive levels

Figure 1 presents the results of the pretest and posttest analysis of students' metacognitive levels based on applying the Kaffah Science learning model. The metacognitive levels are categorized into five distinct levels: Level 1, which involves being aware of thought processes and describing them; Level 2, focusing on developing an introduction to thinking strategies; Level 3, reflecting on procedures evaluatively; Level 4, transferring experience, knowledge, and procedures to other contexts; and Level 5, connecting conceptual expertise with experience. These levels are assessed through a metacognition questionnaire administered to students as both a pretest and a posttest. The posttest results reveal notable improvements across all levels compared to the pretest. Specifically, at Level 1, there is an increase from 60.35 to 82.68; at Level 2, from 57.86 to 73.35; at Level 3, from 53.75 to 80.85; at Level 4, from 58.88 to 75.93; and at Level 5, from 48.95 to 72.35. These findings suggest a positive impact of the Kaffah Science learning model on enhancing students' metacognition skills, as evidenced by the significant improvements in their awareness, thinking strategies, reflective abilities, transfer of knowledge, and the connection of conceptual experiences. Based on the pretest and post-test results, an n-gain analysis was then carried out to evaluate the criteria for increasing students' metacognitive skill scores from the pretest to the post-test. The results are presented in Table 1.

Table 1. Results of n-gain at each level of metacognition

Level of metacognition	Pretest	Posttest	n-gain	Criteria
level (1): being aware of thought processes and describing them.	60.35	82.68	0.56	Moderate
level (2): developing an introduction to thinking strategies.	57.86	73.35	0.37	Moderate
level (3): reflecting on procedures evaluatively.	53.75	80.85	0.59	Moderate
level (4): transfer experience, knowledge, and procedures to other contexts.	58.88	75.93	0.41	Moderate
level (5): connecting conceptual experience with experience.	48.95	72.35	0.46	Moderate

Table 1 presents the results of the n-gain at each Level of metacognition, comparing pretest and posttest scores, along with the calculated n-gain values and corresponding criteria. The metacognitive levels are categorized from Level (1) to Level (5), each representing distinct cognitive skills. The pretest scores range from 60.35 to 48.95, while the posttest scores show improvement, ranging from 82.68 to 72.35. The n-gain values, which indicate the degree of improvement, range from 0.37 to 0.59 across the different levels, all falling within the moderate criteria. Specifically, at Level (1), the n-gain is 0.56; at Level (2), it is 0.37; at Level (3), it is 0.59; at Level (4), it is 0.41; and at Level (5), it is 0.46. These moderate n-gain values collectively suggest a notable enhancement in students' metacognitive skills across various cognitive levels following the implementation of the educational intervention, as outlined in the established criteria for assessment. Furthermore,

student responses during the learning process using the Kaffah Science learning model have been evaluated. The results are presented in Figure 2.

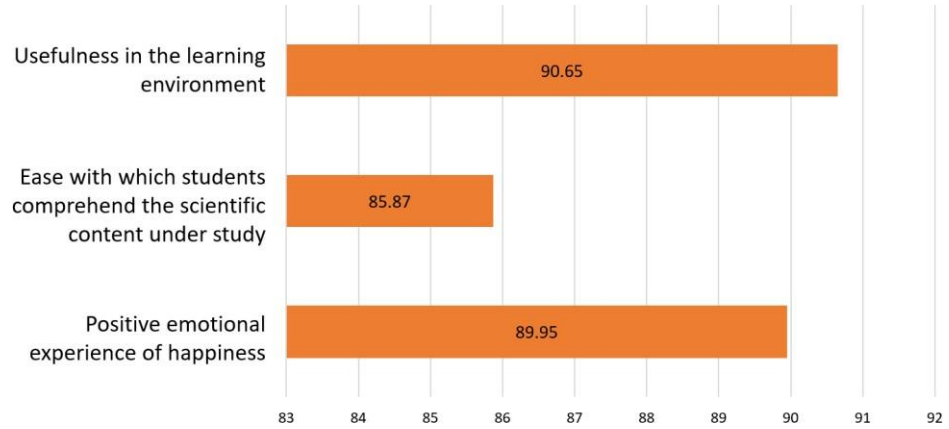

Figure 2. Student responses to learning using the Kaffah Science model

Throughout the learning process employing the Kaffah Science learning model, student responses unveil three pivotal aspects: (a) the usefulness of the Kaffah Sains learning model in the learning environment, (b) the evident ease with which students comprehend the scientific content under study, and (c) the overall positive emotional experience of happiness reported by students throughout the learning process. In quantitative terms, an overwhelming majority of students, constituting 89.95%, expressed their happiness with the learning model, 85.87% acknowledged the ease with which they grasped the science material, and a substantial 90.65% affirmed the practical usefulness of the Kaffah Science model in facilitating their learning experiences. These numerical responses collectively underscore the positive impact of the Kaffah Science learning model, as perceived by students across dimensions of satisfaction, comprehension, and overall utility in the educational context.

Discussion

The research findings presented in this study shed light on the efficacy of the Kaffah Science learning model in enhancing students' metacognition skills. To comprehensively discuss these findings, it is crucial to relate them to the foundational principles of the Kaffah Science model, as outlined by Ayub et al. (2023). Integrating scientific concepts with religion, emphasizing exploration and experimentation, and considering meaningfulness in everyday life form the core principles of the Kaffah Science model. This discussion explores how these principles are reflected in the research findings and the implications for science education.

The Kaffah Science model's emphasis on integrating scientific concepts with religion is apparent in improving students' metacognition skills. The model's orientation of science in the context of religion provides students with a framework

that goes beyond rote learning. The findings suggest that students develop a more comprehensive understanding of the subject by connecting scientific knowledge with religious perspectives. The positive impact on metacognition skills implies that integrating spiritual principles adds depth and meaning to scientific learning, fostering holistic cognitive development.

The research findings align with the Kaffah Science model's emphasis on exploration and experimentation. The significant improvements in metacognition skills across different levels indicate that the model's focus on exploration, mainly through science problems and projects, contributes to a more engaged and reflective learning process. The hands-on approach promoted by the model enhances students' ability to explore scientific concepts actively, reinforcing that practical application and experimentation play a crucial role in cognitive development. This aligns with previous research that students faced with open-ended problems solved through exploration can improve their metacognition skills (Varveris et al., 2023). Experimentation and exploration practices were also influential in encouraging students' cognitive and metacognitive skills (Zhang et al., 2015). Willison et al. (2023) believe that the development of students' metacognition has the potential to have the most significant learning impact in science education, surpassing the contribution of general intelligence.

The Kaffah Science model's principle of considering the meaningfulness of scientific concepts in everyday life is reflected in the positive student responses reported in the research. The students' acknowledgment of the ease with which they grasped scientific content and affirmation of the practical usefulness of the model suggest that integrating science and religion enhances the relevance of learning experiences. This finding emphasizes the importance of making science education meaningful and applicable to students' daily lives, aligning with the Kaffah Science model's overarching goal. The meaningfulness of the learning process received by students provides opportunities for the transferability of learning material content (Darling-Hammond et al., 2020), and students' metacognition in science learning develops along with meaningful learning experiences (Sandi et al., 2011).

They are integrating scientific concepts with religion, emphasizing exploration and experimentation, and considering meaningfulness in everyday life, resulting in the development of a holistic learning model – the Kaffah Science model. The research findings, showcasing improvements in metacognition skills, further strengthen the model's claim to provide a comprehensive educational framework. The holistic nature of the model suggests that when science education is approached with a broader perspective, encompassing religious and practical aspects, it can contribute significantly to students' cognitive development. A holistic learning approach has also received attention from previous researchers, for example, Andrews et al. (2023), where this can be pursued by building an adequate pedagogical system on student transformation needs and the student's mentality. Hamzah et al.'s. (2022) study underlines the importance of a holistic learning

approach to improve students' metacognition skills as one of the higher-order thinking skills.

The Kaffah Science model's organization into general learning phases – orientation of science in the context of religion, exploration and experimentation, and concluding reflection – is evident in the research design and implementation. The reflection allows students to reflect on their learning experiences and hone their metacognition skills. This alignment suggests that the Kaffah Science model's structure is conducive to achieving its intended outcomes. Reflective learning, defined as a purposeful and conscious cognitive process (Mann et al., 2009), has garnered attention in educational research for its potential to impact metacognitive development among students significantly. This approach extends beyond traditional knowledge acquisition, emphasizing active thought processes and self-awareness (Moon, 2013). Integrating reflective learning practices in education has been recognized as instrumental in shaping students' metacognitive skills, influencing their ability to plan, monitor, and assess their cognitive activities (Johnson et al., 2002). One prominent aspect of the impact of reflective learning on metacognitive development is its role in fostering awareness of one's thought processes (Johnson et al., 2002). By engaging in reflective practices, students become more attuned to how they approach learning tasks, leading to a nuanced understanding of their cognitive strengths and weaknesses (Schraw, 1998). This heightened self-awareness enables students to make informed decisions about their study strategies, contributing to refining metacognitive skills.

In the Kaffah Science learning model, the reflective process allows students to develop a deeper understanding of their own thinking strategies (Nicol et al., 2006). Rather than surface-level comprehension, reflective practices encourage students to delve into the underlying thought processes that shape their conclusions. This metacognitive exploration allows students to uncover the reasoning behind their choices, facilitating the refinement and adaptation of cognitive approaches to different learning situations. The evaluative nature of reflective learning contributes significantly to metacognitive development (Schraw, 1998). As students reflect, they assess the outcomes of their actions and decisions, which is crucial for metacognitive growth (Efklides, 2011). This evaluative process prompts students to consider alternative approaches, analyze the reasons behind their successes or failures, and strategize for improvement. The continuous cycle of reflection and evaluation catalyzes the enhancement of metacognitive skills.

Finally, the research findings presented in this study demonstrate the positive impact of the Kaffah Science learning model on students' metacognition skills. By relating these findings to the foundational principles of the Kaffah Science model, we gain a deeper understanding of how integrating science and religion, coupled with an emphasis on exploration, meaningfulness, and reflective practice, contributes to a holistic and practical learning experience. The discussion highlights the model's potential to serve as a valuable pedagogical tool for educators seeking to enrich students' cognitive development and foster a harmonious relationship between

science and religion in the educational context.

Conclusion

In conclusion, the research findings and subsequent discussion present a compelling case for the effectiveness of the "Kaffah" Science learning model in enhancing students' metacognition skills. Integrating scientific concepts with religious principles, coupled with an emphasis on exploration, experimentation, and meaningfulness, has yielded positive outcomes. The study's meticulous analysis, employing a validated metacognition skills questionnaire and a robust experimental design, reveals significant improvements across various cognitive levels. The moderate n-gain values and students' overwhelmingly positive responses to the learning model affirm its potential to contribute to a more comprehensive and interconnected understanding of science and religion.

Moreover, the discussion aligns the research findings with the foundational principles of the Kaffah Science model, highlighting how its unique approach fosters a holistic learning experience. The model's organization into general learning phases, particularly the emphasis on reflective practice, emerges as a crucial element contributing to metacognitive development. The positive impact observed in students' self-awareness, evaluative skills, and ability to connect conceptual experiences signifies the model's potential to shape cognitive processes and lifelong learning habits. As educators continue to seek innovative pedagogical approaches, the Kaffah Science learning model stands out as a promising framework that addresses the integration of science and religion and enhances metacognitive skills, paving the way for a more harmonious and enriching educational experience.

While the findings of this research shed light on the promising potential of the "Kaffah" Science learning model, it is crucial to acknowledge certain limitations that may influence the generalizability of the results. Firstly, the study's focus on teacher education students at Mataram State Islamic University may limit the extrapolation of findings to a broader demographic. Although robust within the chosen context, the sample size may only partially represent the diversity of students across various educational levels or cultural backgrounds. Additionally, while employing a quantitative approach, the research design may benefit from complementary qualitative insights to provide a more comprehensive understanding of students' subjective experiences with the Kaffah Science model. Moreover, the study's duration and the specific academic setting may influence the transferability of the results to different educational environments. Recognizing these limitations is essential for future research endeavors to refine and expand upon the findings of this study in diverse educational contexts and populations.

RECOMMENDATION

It is anticipated that stakeholders will adopt the Kaffah Science Model—an integrated approach that combines religious perspectives with scientific inquiry,

emphasizes experiential learning through experimentation and exploration, fosters reflection on cognitive processes, and ensures the relevance of learning to students' everyday lives. This model holds significant potential to enhance students' mental and metacognitive abilities. By implementing the Kaffah Science Model, a more holistic and meaningful framework for science education can be established, advancing scientific knowledge and strengthening critical thinking, reflection, and self-regulation.

This approach provides a robust foundation for students to understand the interplay between science and their personal lives while cultivating higher-order thinking skills necessary for addressing global challenges in the future. Through this more effective and integrated educational model, students are better equipped to excel academically and become insightful, self-aware individuals capable of making informed, ethical decisions. Adopting the Kaffah Science Model can contribute to developing a future generation that excels in scientific fields while maintaining a solid moral and ethical foundation, equipped to make positive contributions to society and the global community."

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